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A Monographic Study of the North American Species of *Euscelis* and Allied Genera. (Homoptera-Cicadellidae)*

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INTRODUCTION

After a careful examination of all material available for study, an attempt has been made to arrange the species phylogenetically according to structural relationships, using all possible characters. A detailed study has been made of the internal genitalia in an effort to correlate these structures with the external structures. In as far as possible type material has been examined and synonyms have been removed from specific ranking. Correlation between the numerous field observation records of several workers and the laboratory examination of material has been made in an attempt to determine the food habits, the distribution, and the ecological habitats of the species.

ACKNOWLEDGMENTS

This study has been made possible only through the assistance of many workers in this particular field. The work has been completed under the direction of Dr. D. M. De Long who has placed

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at the author's disposal his private library and collection. To him the writer is greatly indebted for many helpful suggestions and criticisms. Professor Herbert Osborn has likewise aided in the carrying on of this work and has also placed at the author's disposal his private library and collection containing a number of types. Dr. E. D. Ball has furnished much valuable material in the form of types and specimens of rare or little known species. In addition he has looked over the manuscript and has offered many helpful suggestions and criticisms. Dr. H. H. Knight has kindly loaned the Iowa State Agricultural College collection containing a number of Osborn and Ball types. Also, Mr. E. P. Van Duzee has furnished valuable material in the form of specimens of several of the more rare species. To these workers the author wishes to express his sincerest appreciation for the much valuable assistance and material so willingly given.

ILLUSTRATIONS

The illustrations which have been used in this study are line drawings to illustrate structures and proportions. For the purpose of making the drawings accurate an ocular micrometer ruled in .05 mm. squares was placed on the diaphragm of one ocular. By superimposing this scale upon the insect structures, all of the exact proportions, curvatures, et cetera, can be transferred with accuracy to coordinate paper. The drawings were then traced upon drawing paper, corrected and inked. The internal genital structures were drawn from ventral and side views in situ.

BIBLIOGRAPHY

Van Duzee's recent catalogue gives numerous references and these will not be repeated here, as it is assumed that any one interested in the group will have access to this catalogue. A brief synonymy is given under each species and also references to recent descriptive literature not included in the Van Duzee catalogue. A general bibliography of the more important papers will be found at the end of this work.

TECHNIQUE

Methods of collecting and preserving leafhoppers will not be discussed here as they are available in a number of works.

In the study of the internal genitalia the following technique has been used. The specimen to be examined is placed ventral side up on a small piece of cork set upon the stage of the binocular.

The abdomen is then carefully separated from the thorax by inserting the point of a small scalpel or needle between the last thoracic segment and the first abdominal segment. The tip of the abdomen is then placed in a small vial of saturated caustic potash and allowed to stand. The length of time the specimen is left in the solution depends upon the degree and color of chitinization. Light and delicate specimens need only be left in for an hour or two while the dark heavy specimens may require several days. Boiling the specimen in caustic potash has proven very satisfactory and it can usually be sufficiently cleared in a few minutes. When cleared the specimen is removed from the caustic solution and placed in a small glass cup containing glycerine and examined. Glycerine proved to be an excellent medium in which to study the specimen, allowing it to be moved about freely. After carefully studying the structures from all angles the drawings were made. In making the lateral view drawings it was found convenient to embed the specimen in glycerine jelly, which held it firm and in the angle desired, yet was perfectly transparent. In cases of doubt as to certain internal characters, the external structures were carefully dissected, thereby fully exposing the internal structures. After drawing, the specimens were placed in small individual vials, carefully labeled, and preserved in 70% alcohol.

THE GENUS *EUSCELIS* AND ALLIED GENERA

Some confusion exists concerning the oldest tribal name for the group. The genus *Euscelis* was established by Brullé in 1832 and *lineolatus* Brullé has been designated as the type. A detailed study of the external characters and of the internal genitalia of *lineolatus* indicates that *Euscelis* is a valid genus and that a number of American species are very closely related to *lineolatus*. *Athysaninae* must therefore go into synonymy and *Euscelinae* stand as the oldest tribal name for the group.

Osborn and Ball in 1902 divided the genus into four subgenera. Two European genera have recently been erected, Edwards in 1922 proposing the genus *Ophiola* with *striatulus* Fallén designated as the type and the genus *Drylix* with *striola* Fallén as its type. Ball in 1929 made a brief revision of the genus, raising Osborn and Ball's subgenera to generic ranking and erecting the genus *Remadosus* with *magnus* Osborn and Ball as the type and the genus *Exitianus* with *obscurinervis* Stål as the type. All of the groups are recognized as valid genera in this study. Also, a new genus is established and the genus *Amplicephalus* is removed from the *Delto-*

cephalinae and included in the *Euscelinae*. With the idea of a critical examination of these divisions as well as to present keys and illustrations of characters, a revision has been undertaken. A combination of characters is used throughout the work to separate, group, and key the species.

CHARACTERS USED IN CLASSIFICATION

Head

The vertex and frons are the principal head structures used in classification. The vertex is the dorsal area of the head lying between the compound eyes. The proportion of length to width and the angle with which it meets the front are constant and important characters in the separation and the grouping of the species. The vertex merges anteriorly into the frons or front, which, although a separate sclerite and lying in a different plane, is not separated by a definite suture. The vertex may be rather sharply angled with the front, forming a definite margin, or rounded to the front, forming a thick rounded margin.

Thorax

The more important taxonomic structures of the thorax are the pronotum and scutellum. The pronotum covers the entire dorsal surface of the prothoracic segment and no sutures are present to indicate subdivisions.

The large triangular shaped sclerite commonly known as the scutellum is composed of the mesothoracic scutum and scutellum, which are almost completely fused, a transverse groove near the middle is the only indication of two sclerites.

Wings

Wing venation in several of the groups is valuable. It is often irregular and in certain groups the second cross nervure is present. In a number of forms the venation is indistinct, being obscured by colorations, which usually are valuable in separating the species.

Abdomen

In the female the sternum of segment seven, usually known as the last ventral segment, is one of the most important taxonomic structures. The posterior margin may be variously modified in different species so that it may contain deep notches, tooth like structures or concave emarginations, or appear lobed. It is often thickly chitinized and frequently bears conspicuous color markings.

In several species another structure occurs in connection with the sternum of segment seven which is referred to by other authors as the underlying membrane. It occurs in *comma*, *colon*, *sexvittatus*, *curtisi*, *texanus*, *dentatus*, and *lassus*.

The ninth segment of the female is the largest of the whole abdomen and is apparently composed of one plate, the tergum, which curves dorsally around the body, extending ventrally to the sides of the ovipositor. In taxonomic work they are generally referred to as the pygofer and may be strongly inflated laterally and beset with spines, especially in the ventral and apical regions. The ovipositor usually exceeds the pygofer in length.

In the male the sternum of segment seven is not variously modified as in the female. The sternum of segment eight is also unmodified, and is usually spoken of as the last ventral segment, the posterior margin appearing evenly concavely rounded or truncate and not differing from the previous sternum. The tergum of segment nine forms what is termed the pygofer and is often pubescent, especially in the apical region. The sternum of segment nine is usually a triangular plate, attached to the tergum by only a narrow margin and is termed the valve. A pair of structures appear to rise from and apparently are fused with the valve. They are often broad and variously produced and the apices may be rounded, pointed or truncate. These structures are termed the plates.

The Internal Genitalia

The internal structures are found in the genital chamber which is formed by the ventral genital plates and pygofer. These structures are composed of three parts, the styles, the oedagus, and the structures connecting these two, the style-oedagus connectives. These structures are probably modified appendages and arise from the ninth segment.

The styles are always paired and lie upon and are attached to the dorsal parts of the plates. They vary in shape, more specific variations are usually to be found in the terminal portions. The greater portion of the styles lie in the genital chamber, but the anterior portion often extends cephalad into the abdominal cavity. It is thought that the styles are used as claspers. A chitinous plate at the base which often appears as a pair of plates slightly joined, connects the two styles and also the styles to the oedagus. Hence, these structures are known as the style-oedagus connectives.

The oedagus is a chitinous structure posterior to and joined at its anterior end to the connectives. It appears to function as the

penis sheath. The basal or anterior end is often enlarged and prolonged dorsally, usually attached to the genital membrane. The terminal portion also varies in shape and may be provided with hooks, barbs or spines. In the different species various shapes are noticed, which are, however, quite constant within the species.

Coloration

Although the coloration varies greatly in intensity the color pattern is quite definite in a number of species. These markings usually appear on the vertex or on the elytra in the form of transverse bars, rounded spots or longitudinal stripes. They are most important in the *Stirellus*, *Commellus*, *Remadosus*, *Drylix*, and *Ophiola* groups.

SYSTEMATIC

KEY TO THE GENERA OF THE *Euscelis* GROUP

- | | | |
|--|---|--------------------------|
| 1. Vertex parallel margined or slightly produced, much wider than long..... | 2 | |
| Vertex definitely produced, flat or conical | 5 | |
| 2. Vertex parallel margined, short and very broad | 3 | |
| Vertex with anterior margin slightly produced | 4 | |
| 3. Vertex four times as broad as long, species very large | | <i>Remadosus</i> Bell |
| Vertex three times as broad as long, species small, elongate and wedge-shaped | | <i>Drylix</i> Edwd. |
| 4. Vertex strongly convex between eyes, bluntly rounding to strongly inflated front, elytra light, nervures paler, ovipositor normal | | <i>Athysanus</i> Burm. |
| Vertex not strongly convex, front not inflated, elytra sub-hyaline, nervures dark, ovipositor extremely long | | <i>Exitianus</i> Ball |
| 5. Vertex broad, distinctly wider between eyes than length on middle..... | 6 | |
| Vertex narrow, basal width less than length on middle | | <i>Stirellus</i> O. & B. |
| 6. Vertex and front obtusely or acutely conically produced | 7 | |
| Vertex and front angled, flat | | <i>Commellus</i> O. & B. |

7. Form broad and robust, species straw colored 8
 Form not unusually broad, species small 9
8. Vertex bluntly conical, convex transversely and sloping to front *Euscelis* Brul.
 Vertex flattened at base, very thickly bluntly angled with front *Amplicephalus* De L.
9. Vertex and front acute conically produced, markings in form of transverse bands *Ophiola* Edwd.
 Vertex produced, very slightly wider between eyes than length on middle, right angled *Amblysellus* n. g.

Genus *Remadosus* Ball
 Plates I, VI, and X

Remadosus Ball, Trans. Ent. Soc. Amer., LV, p. 3, 1929.

Vertex extremely short and broad, parallel margined, transverse, broadly rounding to front. Ocelli situated in a slight depression, distant from the eyes, distinctly below the level of the disc. Species very large. Venation simple.

Type of genus *Athysanus magnus* Osborn and Ball.

The species of this genus are very large with transverse heads and of a fuscous or black coloration.

KEY¹ TO SPECIES OF *Remadosus*

- Definite ivory white costal stripe and usually an ivory white band on pronotum *magnus*
 Costal margin of elytra of same shade as disc, ivory band on pronotum faint or absent *fumidus*

Remadosus magnus Osborn and Ball (Plates I, VI, and X)

Athysanus magnus Osborn and Ball, Proc. Ia. Acad. Sci., IV, p. 225, 1897.

Euscelis (Athysanus) magnus var. *piceous* Osb., Fla. Ent., VI, p. 19, 1922.

A large, rusty straw colored species distinguished by a definite ivory white costal band. Length 7 mm.

Vertex short, broad, almost parallel margined, four times as broad as long. Elytra distinctly longer than abdomen.

¹ Adopted from Ball

Color: variable, rusty straw to quite dark, vertex, pronotum and scutellum finely irrorate with fuscous, transverse ivory band on pronotum. Elytra dark, nervures pale fuscous, margined with light. Front dirty straw. Venter light.

Genitalia: Female last ventral segment as long as preceding, posterior margin roundingly produced, triangularly notched at middle, forming two rounding lobes, lateral angles produced, roundingly lobe-like. Male valve short, obtusely angled, triangular; plates four times as long as valve, tapering gradually to acute antennuated apices.

Species variable in intensity of color, darker form usually with a more prominent pronotal stripe, internal genitalia identical.

Distributed in the plains and prairie regions from eastern Wyoming and Colorado to Iowa and Minnesota, southward to Nebraska and Kansas and again along the Gulf coast in Louisiana, Mississippi, and Florida. Osborn and Ball report taking it from *Spartina michauxiana* in Iowa and Colorado. Nymphs and adults of both the light and dark forms have been taken in abundance on *Spartina patens* in a low meadow just above the tide flats at Tampa, Florida (Ball).

Type locality Ames, Iowa. Type in Agricultural College Collection, Ames, Iowa. Type examined, also specimens from Florida, Mississippi, and Iowa.

Remadosus fumidus Osborn (Plates I, VI, and X)

Euscelis (Athysanus) fumidus Osborn, Fla. Ent., Vol. VI. No. 2, p. 19, 1922.

Euscelis (Athysanus) drakei Osborn, Fla. Ent., Vol. VI. No. 2, p. 19, 1922.

Resembling *magnus* in size and form but readily distinguished by the costal margin being same shade as disc, ivory band usually present on pronotum. Female segment distinct. Length 6.5 mm.

Vertex short, almost parallel margined, four times as wide as long. Pronotum twice as broad as long, transverse.

Color: Variable, reddish to dark fuscous. Vertex finely irrorate with fuscous. Elytra dark, usually mottled with milky spots, nervures not distinct. Front, clypeus, and lorae dark fuscous with yellow irrorations.

Genitalia: Female last ventral segment slightly longer than preceding, posterior margin slightly roundingly pro-

duced and deeply narrowly incised at middle, lateral angles produced and broadly rounding. Male valve short, obtusely angled; plates triangular, four times longer than valve, apices acute.

A species variable in color, the dark *drakei* form showing no specific external structural differences and with internal genitalia identical with *fumidus*.

Described from a single male specimen collected at Chester, Georgia, and since collected from Florida in a low flat woods between cypress swamps from an association of *Rynchospora* sp. and *Spartina* sp. (Ball).

Type locality, Chester, Georgia. Type in Osborn collection. Type examined, also specimens from Sanford, Florida.

Genus Athysanus Burmeister¹

Plates II, VI, and X

Athysanus Burmeister, Genera Ins., pl. 14, 1838.

Vertex short, slightly roundingly produced, disc convexly rounding to strongly inflated front, head with distinct swollen appearance. Venation of elytra simple. Apical cells slightly longer than broad. Ovipositor normal.

Type *argentatus* Fab.

Species much broader and shorter than *Exitianus*, not wedge-shaped, almost parallel margined.

Athysanus frigidus Ball (Plates II, VI, and X)

Athysanus frigidus Ball, Ent. News, X, p. 172, 1899.

A short robust species with a broad, rounding, inflated vertex and front, four black spots on anterior margin of vertex. Length 4-4.5 mm.

Vertex broadly rounding to tumid front, two and one half times as wide between the eyes as long, one half longer on middle than against eyes. Elytra slightly longer or equaling abdomen in length.

Color: Vertex whitish yellow, shining, four black spots on anterior margin, usually a small pair of spots on disc. Pronotum with four irregular black spots on anterior margin. Elytra pale, occasionally with fuscous bands, nervures

¹ According to Olsen *Eutettix osborni* Ball equals *Athysanus stactogalus* of Europe. However, this species is the type of the genus *Opsius* Fieb. and should be known as *Opsius stactogalus* Am.

paler. Face straw color with a pair of dark spots below median pair on vertex. Sutures dark. Venter pale.

Genitalia: Female last ventral segment twice as long as preceding, lateral angles produced, posterior margin slightly roundly produced on median third. Male valve broadly obtusely rounding; plates triangular, twice longer than valve, outer margin slightly concavely emarginate, apices bluntly acute.

Present records indicate its distribution in Colorado, Western Utah, Nevada, California, North Dakota and Idaho. Dr. Ball reports taking it in abundance feeding on *Artemisia frigida*.

Type locality Ft. Collins, Colorado. Type in Ball collection. Type examined, also specimens from states previously mentioned.

Athysanus almus Van Duzee (Plate II)

Euscelis almus Van Duzee, Proc. Calif. Acad. Sci., XIV, No. 17, p. 421, 1925.

The following is the original description: Allied to *frigidus* Ball, a little narrower, with more pointed head; vertex with three round black spots, one of which is discal; clytra faintly fuliginous with pale nervures and fuscous marks in apical areoles. Length 4 mm.

Head a little wider than pronotum, vertex nearly horizontal at base, broadly rounded to base of front, polished. Front moderately broad, one-half longer than broad, nearly flat; sides slightly narrowed to apex; clypeus oblong, apex rounded, sides feebly excavated; lorae narrow. Pronotum a little longer than vertex, outer angles broadly rounded. Elytra with one or two supernumerary cross veins near apex of costa. Last ventral segment of female rather deeply, angularly excavated. Valve of male longer than ultimate segment, roundly triangular. Plates long, obtuse at apex, sides feebly arcuated, contracted at base.

Color: Pale yellowish, deeper on head; vertex with three round black spots, median paler, placed forward of the lateral and minutely notched before; lateral placed near the eyes and just above the line of the ocelli; face with a row of four large black spots below margin, the lateral on the temples above the antennae; sutures of the face and about six arcs fuscous; pronotum scarcely darkened across the disc on anterior margin; scutellum usually with black spots near basal angles and two brown discal dots, apical field sometimes with two brown spots. Elytra pale smoky with conspicuous pale nervures. Apical transverse veins marked with brown

and a brown vitta borders the apical veins; pleural pieces and abdomen more or less black, the last ventral segment of female with a black spot at fundus of notch; suture and dorsum of male pygofers black; legs pale, claws black.

No specimen of this species was available for study. Dr. Ball has recently placed it in the genus *Athysanus*.

Type locality Los Banos, Merced Co., Calif. Type in Mus. Calif. Acad. Sci.

Genus *Exitianus* Ball

Plates IV, VI, and X

Exitianus Ball, Trans. Ent. Soc. Amer., LV, p. 5, 1929.

Vertex bluntly angled, convex between eye, anterior margin rounding to front, the front not inflated. Venation of elytra simple, apical cells much longer than broad, appendix broad. Ovipositor extremely long, acutely produced, greatly exceeding the slender pygofers.

Type of genus *obscurinervis* Stål.

Species usually with dark spots on vertex and smoky hyaline elytra.

Exitianus obscurinervis Stål (Plates IV, VI, and X)

Jassus (*Thamnotettix*) *obscurinervis* Stål, Eug. Resa.

Ins. Hemip. p. 293, 1858. (S. A.)

Cicadula exitiosa Uhl., Am. Ent. III, p. 72, 1880. (U. S.)

Athysanus picatus Gib., Proc. Bic. Soc. Wash. 32 p. 26, 1919 (C. A.)

Athysanus miniaturatus Gib., Proc. Bic. Soc. Wash. 32 p. 26, 1919. (C. A.)

Euscelis obscurinervis Osborn, Annals Carnegie Museum, Vol. XV, p. 412.

A variable species in size and intensity of coloration, with blunt head, hyaline elytra and distinct genitalia.

Vertex obtusely angular, slightly over one-half as long as basal width, anterior margin broadly and thickly rounding to wedge-shaped front. Elytra exceeding abdomen in length, appendix broad, apical cells long and narrow.

Color: Vertex pale grayish white, often tinged with orange yellow, ocelli red, pair of large round black spots on margin, often a smaller one between, two oblique dashes on basal angles, a brownish transverse crescent between the

often enlarged anterior extremities and parallel to the anterior margin. Pronotum with a row of irregular black spots. Scutellum with a pair of triangular spots on basal angles and an irregular line either side of middle. Elytra hyaline, nervures dark fuscous. Face pale yellow with dark arcs, sutures dark. Venter pale.

Genitalia: Female last ventral segment twice longer than preceding, truncate, posterior margin slightly convexly produced on middle; ovipositor greatly exceeding pygofers. Male plates long, narrow, two and one-half times length of valve, tapering gradually, outer margins weakly concave, tips acute, often divergent and clothed with stout hairs.

Species very widely distributed, common throughout the United States, having only recently spread over the north. It is probably a native of South or Central America and has migrated to the West Indies, United States and northward. It occurs very abundantly on the grasses, often overrunning wheat and fall rye, where it frequently accumulates in great numbers and does considerable damage. Apparently there are two broods a season in the North (Osborn and Ball).

Type localities Buenos Ayres and Rio Janeiro. Type probably in Stockholm Museum. Numerous specimens examined from many localities in United States, Mexico, Cuba, and Brazil.

Genus *Drylix* Edwards

Plates I, VII, and IX

Drylix Edwards, Ent. Mo. Mag., LVIII, p. 207, 1922.

Vertex short, not extremely broad, slightly produced, almost parallel margined, rounding to front. Ocelli distinctly below the level of the vertex. Venation of elytra simple, apical cells elongated.

Type of genus *striola* Fallén.

The species of this group usually have a black band on vertex and the female segment is excavated.

KEY TO SPECIES OF *Drylix*

- | | |
|--|-------------------------|
| 1. Vertex definitely produced, not transverse, male plates triangular | <i>striolus</i> Fall |
| Vertex not definitely produced, almost parallel margined, male plates not triangular | 2 |
| 2. Male plates convexly rounding, semi-circular | <i>parallelus</i> V. D. |

Male plates not semi-circular	3
3. Male plates with truncate apices	truncatus n. sp.
Male plates produced caliper like	4
4. Plates long, caliper like, apices narrowly produced	<i>divaricatus</i> S. & Del.
Plates short, caliper like, apices thickly bluntly produced	<i>uncolus</i> Ball

Drylix striolus Fallén (Plates I, VII, and IX)

Cicada striola Fallén, Acta Holm, XXVII p. 31, 1806.

A small wedge-shaped species, greenish yellow in color. Genitalia distinct. Length 4-5 mm.

Vertex a little less than one-half as long on middle as wide between the eyes, slightly longer than half the length of the pronotum.

Color: Vertex greenish yellow with a transverse black band just back of ocelli. Pronotum and scutellum greenish yellow, usually without markings. Elytra pale greenish hyaline, nervures pale. Face dark with ares of yellow; legs and venter yellowish. Ovipositor black.

Genitalia: Female last ventral segment one-half longer than preceding, lateral margins obliquely sloping, posterior margin strongly concavely hollowed, ovipositor exceeding pygofers. Male valve obtusely triangular; plates four times longer than valve, convexly rounding to blunt apices.

This species is widely distributed throughout the Northeastern United States, extending as far westward as the Dakotas and Colorado and southward to New Jersey and northward into Ontario. Common in swampy regions where small sedges abound. Dr. De Long reports it on *Juncus*, *Cyperus diandrus*, and *Carex-Phragmites* association at Presque Isle, Pennsylvania.

Type probably in Stockholm Museum. Numerous specimens examined from a great variety of localities.

Drylix parallelus Van Duzee (Plates I, VII, and IX)

Athysanus parallelus Van Duzee, Can. Ent., XXIII, p. 169, 1891.

A pale yellowish green species resembling *striolus* but larger, with a shorter head and distinct genitalia. Length 6 mm.

Vertex distinctly parallel margined, not longer on middle than against eyes. Elytra distinctly longer than abdomen.

Color: Vertex pale yellowish green, a broad shining black band just back of ocelli. Elytra pale greenish subhyaline, nervures with yellowish tint. Face yellow with several dark arcs. Venter light yellow. Ovipositor black.

Genitalia: Female last ventral segment twice longer than preceding, truncate behind, lateral angles rounding, a deep triangular median notch extending to near middle of segment. Male valve broad as the ultimate segment; plates narrower, twice as long as valve, convexly rounding to blunt divergent apices.

Widely distributed in Northeastern United States extending from Ontario southward to New Jersey and westward to Colorado, where it occurs in swampy and marshy places. Dr. De Long reports it common on *Juncus* and small sedges along lagoon margins at Presque Isle, Pennsylvania.

Type locality South Falls, Ontario. Type doubtful, in Agricultural College collection, Ames, Iowa, or in Cornell University collection. Specimens examined from numerous localities.

Drylix truncatus n. sp. (Plates I, VII, and IX)

Similar in size and structure to *parallelus*, but of darker color and with distinct genital characters. Length 5 mm.

Vertex broad, almost parallel margined, three times as broad as long. Pronotum twice as long as vertex. Elytra long, greatly exceeding abdomen.

Color: Vertex greenish yellow, a broad black band just back of ocelli, anterior margin of pronotum narrowly black, a broad transverse band on posterior half. Disc of scutellum black, a pair of black spots in basal angles. Elytra dark, nervures pale. Face dark with about seven arcs of yellow. Venter dark.

Genitalia: Male valve broad, bluntly angled; plates short, only slightly exceeding valve, almost as broad at apices as at base, truncate.

Described from two male specimens, one collected at Prentice, Ohio, and one at Lakeside, Ohio, on July 17, 1916.

Type in De Long collection.

Drylix divaricatus Sanders and De Long (Plates I, VII, and IX)

Euscelis divaricatus Sanders and De Long, Pro. Ent. Soc. Wash., Vol. 25, No. 7-8, 1923.

Very similar in general appearance to *parallelus* but with distinct genital characters. Length 5.5 mm.

Vertex almost parallel margined, three times as broad as long. Pronotum twice longer than vertex. Elytra long, greatly exceeding abdomen in male. Length 5.5 mm.

Color: Greenish yellow, vertex with black transverse band just back of ocelli, a small spot on apex. Pronotum and scutellum without markings. Elytra smoky. Front with remnants of about eight pairs of ares, heavy undulating line below ocelli, dark. Venter dark.

Genitalia: Female last ventral segment one-half longer than preceding, posterior margin almost truncate, only slightly excavated on median third, black margined. Male valve broad, triangular; plates slightly longer than broad at base, outer margin convexly rounding, inner margins approximate one-half their length, then abruptly concavely rounded to widely divergent, acutely produced tips.

Described from a single specimen collected at Presque Isle, Pennsylvania, where it occurred with *parallelus* in a sedge habitat. It has been reported from Idaho (Haegele).

Type locality Presque Isle, Pennsylvania. Type in De Long collection. Type examined, also specimens from Idaho.

Drylix uncolus Ball (Plates I, VII, and IX)

Drylix uncolus Ball, Trans. Am. Ent. Soc., Vol. LV, p. 6, 1929.

Resembling *divaricatus* in general appearance but with genital characters distinct. Length 5.5 mm.

Vertex almost parallel margined, slightly produced, three times as broad as long. Pronotum twice as long as vertex. Elytra not greatly longer than abdomen.

Color: Vertex greenish yellow, broad transverse black band just back of ocelli, arcuate line on apex and two transverse sinuate lines along posterior margin next either eye. Elytra brownish, nervures pale. Ovipositor black.

Genitalia: Female last ventral segment longer than preceding, lateral margins long, acutely produced, posterior margin deeply concavely excavated on median third, semi-circular, heavily margined with black. Male valve broad, obtusely angular; plates as broad at base as long, outer margins convexly rounding, inner margins approximate less than one-half their length, then rounded to thick, stubby, caliper like apices.

This species was taken by sweeping a wet meadow (Ball). Known only from Utah and North Dakota.

Type locality, Peterboro, Utah. Type in Ball collection.

Specimens examined from Devil's Lake, North Dakota and Mantua, Utah.

Genus *Euscelis* Brullé¹

Plates II, VII, and IX

Euscelis Brullé, Expéd. Sci. Morée, III, p. 109, 1832.

Vertex bluntly conically produced, disc convex between the eyes, slightly more convex at apex than at base, rounding thickly to front. Form broad and stout. Elytra usually shorter than abdomen, second cross-nervure often present, apical cells short and broad.

Type of genus *lineolatus* Brullé.

Species belonging to this group generally straw colored. Female segment always concavely excavated and usually bearing a small black triangular tooth at apex.

KEY TO SPECIES OF *Euscelis*

- | | | |
|--|---|---------------------------|
| 1. Male plates with apices divergent | 2 | |
| Male plates with apices antennuated | 3 | |
| 2. Species small, 4 mm. or less | | <i>ovatus</i> S. & DeL. |
| Species large 5 mm. or over | | <i>extrusus</i> V. D. |
| 3. Male plates rounding regularly to blunt apices | 4 | |
| Male plates with truncate apices | 5 | |
| 4. Vertex short, broadly rounding, scarcely produced, less than one-third longer on middle than against eye | | <i>deceptus</i> S. & DeL. |
| Vertex produced, obtusely angled, over twice longer on middle than against eye | | <i>alpinus</i> Ball |
| 5. Vertex short, broadly rounding, less than one-half longer on middle than against eye. Female segment bearing median tooth | | <i>relativus</i> G. & B. |
| Vertex strongly produced, twice longer on middle than against eye. Female segment not bearing median tooth | | <i>hyperboreus</i> V. D. |

Euscelis extrusus Van Duzee (Plates II, VII, and IX)

Athysanus extrusus Van Duzee, Can. Ent. XXV, p. 283, 1893.

A broad stout species, variable in color, resembling *obsoletus* but with a longer vertex and distinct genitalia.

¹ This name will supersede *Metathysanus* Dahl and *Conosanus* O. & B. as the oldest generic name for this group.

Length, brachypterous form 5-5.5 mm., macropterous form 6 mm.

Vertex obtusely angled, almost three-fourths as long as width between eyes. Elytra broad, rounded behind, in brachypterous form exposing the pygofers in female and plates in male. Apical cells short and broad. Second cross-nervure often present.

Color: Vertex light straw, an oblique pair of spots at apex, a transverse spindle shaped marking between eyes, dark fuscous. Pronotum and scutellum dirty straw with irregular markings. Elytra light straw, nervures paler, areoles margined with fuscous. Front pale with arcs of fuscous, sutures dark. Venter pale. In pale specimens markings may be faint or entirely absent.

Genitalia: Female last ventral segment twice the length of the preceding, lateral margins rounded and sloping inwardly to acutely pointed lobe, between these rather deeply excavated. Male valve obtusely triangular; plates roundly cut out from inside to the parallel outer margins, three times the length of the valve, style like tips of the pygofers extending beyond the plates.

Species common to northeastern United States and Ontario. It has been taken from fresh water marshes (De Long) and low ground meadows and pastures (Osborn and Ball). No detailed data is available on its life history. Osborn and Ball report one generation a year in Iowa, overwintering in the nymphal state.

Type localities Portage Falls, New York, and Northford, Connecticut. Type doubtful, in Agricultural College collection, Ames, Iowa, or in Cornell University collection. Numerous specimens examined from a great many localities.

Euscelis ovatus Sanders and De Long (Plates II, VII, and IX)

Euscelis ovatus Sanders and De Long, Bull. Bur. Plant Industry, Penna., Vol. III, No. 15, p. 161, 1920.

Resembling *extrusus* in general appearance but readily distinguished by the smaller size, distinct style like processes of the pygofers and distinct genitalia. Length 4 mm.

Vertex obtusely angled, slightly longer on middle than half the width between the eyes. Pronotum twice as broad as long, one-third longer than vertex. Elytra broad and distinctly shorter than abdomen in both sexes.

Color: Vertex pale straw, a pair of median transverse spots, rounding on median side and tapering to a line just

back of ocelli, dark brown. Pronotum pale yellow, often irregularly marked with fuscous. Scutellum usually with an irregular pair of spots on anterior margin. Elytra pale, nervures light, often narrowly margined with fuscous. Face pale straw with about eight arcs of fuscous, sutures dark. Vertex dirty straw with occasional dark markings.

Genitalia: Female last ventral segment longer than preceding, lateral margins sloping inwardly to pointed lobes, posterior margin between these abruptly shallowly excavated either side the slightly roundly produced middle. Male valve obtusely rounding; plates triangular, distinctly broader than long, convexly rounding on inner and outer margins to blunt apices, diverging immediately at apex of valve, exposing the oedagus and curved style like process of the pygofers.

Described from specimens collected from wheat at Wellington, Kansas, and since collected in Texas (Tucker).

Type locality Wellington, Kansas. Type in Sanders and De Long collection. Type examined, also specimens from Texas.

Euscelis alpinus Ball (Plates II, VII, and IX)

Athysanus alpinus Ball, Ent. News, X, p. 173, 1899.

Size and form of *deceptus* but with different color pattern and more pointed vertex. Genitalia distinct. Length 4.5 to 5 mm.

Vertex distinctly angled, two-thirds as long as broad, slightly more than twice as long on middle as against eyes. Elytra shorter than abdomen in female, slightly longer in male.

Color: Vertex pale straw colored, two transverse fuscous bands, the anterior one narrow, arising just back of ocelli against eyes, angling forward, nearly parallel with vertex margin, paralleled posteriorly by a broader, more irregular one. Pronotum and scutellum pale, pronotum with four irregular longitudinal stripes not reaching anterior margin, median pair produced onto scutellum, confluent. Elytra pale, nervures paler, occasionally margined with fuscous blotches. Face bright yellow, with arcs of dark fuscous. Venter pale.

Genitalia: Female segment longer than preceding, lateral angles rounding, posterior margin slightly concavely excavated, a stout median process armed with two divergent teeth. Male valve broad as ultimate segment, rounding; plates triangular, three times length of valve.

Described from numerous specimens taken from a damp mountain meadow in Colorado and since reported from New Hampshire (Slosson). Nothing is known regarding its food plant.

Type locality Little Beaver, Colorado. Type in Ball collection. Type examined.

Euscelis obsoletus Kirschbaum¹ (Plates II, VII, and IX)

Athysanus obsoletus Kirschbaum, Die Athysanus arten
V. Wiest., p. 7, 1885.

A straw colored species resembling *deceptus* in general appearance but distinguished by the more angled vertex. Length 5-5.5 mm.

Vertex broader and distinctly more angled than in *deceptus*, longer on middle than half the width between the eyes. Elytra usually exceeding the abdomen.

Color: Vertex, pronotum, and scutellum dirty yellow, vertex with a pair of irregular black spots between eyes on disc, a pair of oblique dashes above and a pair of small spots against either eye, dark brown. Elytra testaceous. Venter dark.

Genitalia: Female last ventral segment twice longer than preceding, lateral angles rounding, posterior margin shallowly excavated, slightly narrowly produced at apex. Male valve triangular; plates convexly rounding to blunt apices, two and one-half times longer than valve.

This species apparently does not occur in this country. No American forms were found to agree with European examples from Dr. China and Dr. Melichar. The internal genital characters are distinct from all forms examined.

Numerous specimens were examined from Germany, Ireland, England and Scotland.

Euscelis deceptus Sanders and De Long (Plates II, VII, and IX)

Euscelis deceptus Sanders and De Long, Ann. Ent. Soc.
Am., X, p. 87, 1917.

In size and form resembling *obsoletus*, but distinguished by a much shorter, more rounding vertex. Length 5.5 to 6 mm.

Vertex short, broadly rounding, less than one-half as long as wide, scarcely one-third longer on middle than against eye. Elytra broad, exceeding abdomen.

¹ Apparently this species, from the determinations at hand, does not occur in North America.

Color: Ocelli blood red. Vertex, pronotum, and scutellum straw colored, vertex with irregular transverse brown markings, pronotum with a row of indistinct spots, a pair of irregular spots on disc of scutellum. Elytra dirty with intermediate brown markings, nervures indistinct. Front pale as also the venter.

Genitalia: Female last ventral segment twice longer than preceding, lateral angles rounding to the broadly excavated posterior margin, bearing at its apex a small median tooth, black. Male valve short, triangular; plates broad, three times longer than valve, convexly rounding to blunt apices.

Species common to North America. Very common in the New England states, Ohio, Illinois, Wisconsin, and South Dakota. Specimens of *Athysanus sahlbergi* Reut. from Dr. China appear to agree with *deceptus* and further study may show them to be the same.

Type locality Wisconsin. Type in De Long collection.

Type examined, also specimens from states previously mentioned.

Euscelis relativus Gillette and Baker (Plates II, VII, and IX)

Athysanus relativus Gillette and Baker, Hemip. Colo., p. 93, 1895.

A short stout straw colored species resembling *deceptus* but smaller and with distinct genitalia. Length 4 mm.

Vertex obtusely angled, slightly over one-half as long as width at base. Elytra short, rarely reaching to the end of the abdomen, rounding behind.

Color: Ocelli reddish, vertex straw colored, often with a few irregular pale fuscous markings. Elytra pale yellowish subhyaline, nervures not distinct. Face pale with dark arc, sutures dark. Venter pale yellow.

Genitalia: Female last ventral segment longer than preceding, lateral angles rounding to posterior margin, which is rather deeply roundly excavated, bearing at its apex a short, black, acutely pointed tooth. Male valve short, obtusely triangular; plates two and one-half times as long as valve, convexly rounding to broad, truncate apices. Margins sparsely fringed with hairs.

At the time of this study the type of this species was unavailable and Professor Sanders' identification has been used. This form appears as *obsoletus* in Professor Osborn's collection.

Specimens were examined from Ireland and Scotland and found to agree with American forms. Distinctly northern in distribution, common in New England and Vancouver Island. It has also been reported from Illinois, Iowa, and Wisconsin. No definite host plant has been designated but it probably feeds on grasses. Professor Osborn reports sweeping it from timothy.

Type locality Fort Collins, Colorado. Type probably in Baker collection, United States National Museum. Specimens examined from Maine and Wisconsin.

Euscelis hyperboreus Van Duzee (Plates II, VII, and IX)

Euscelis hyperboreus Van Duzee, Rept. Can. Arc. Exped.,
Vol. III, 1919.

Resembling *extrusus* in form and general coloration, but smaller and with distinct genitalia.

Vertex strongly produced, distinctly angulate, longer on the middle than width between eyes. Elytra short, only slightly exceeding abdomen in the male, much shorter in the female.

Color: Yellowish testaceous. Vertex with arcuated line on anterior margin, reaching from apex to ocelli, a transverse line between ocelli. Pronotum with about 10 faint marks on anterior margin. Scutellum with a pair of dashes on disc. Elytra yellowish, nervures pale, margined with broken fuscous. Front yellowish with about 8 pair of fuscous ares. Legs pale. Venter dark.

Genitalia: Female last ventral segment as long as preceding, posterior margin deeply concavely hollowed, very slightly and narrowly produced at apex. Male valve triangular; plates about as broad at truncate apices as at base.

Type localities Kongenevik, Camden Bay, Alaska, and Bernard Harbor, Northwest Territories. Type in the National collection of Insects, Ottawa.

Specimens examined from Nome, Alaska.

Genus *Ophiola* Edwards

Plates III, VIII, and IX

Ophiola Edwards, Ent. Mo. Mag., p. 206, 1922.

Vertex produced in front of eyes, acutely conical, disc not strongly convex between eyes, sloping regularly from pronotum to apex. Form small, narrow, and elongate.

Type of genus *striatulus* Fallén.

The species placed in this genus can usually be recognized by the black coloration on the vertex in the form of transverse bars.

KEY TO SPECIES OF *Ophiola*

- | | | |
|--|----|---------------------------|
| 1. Elytra but little exceeding the body,
apical cells broad and relatively
short | 2 | |
| Elytra definitely longer than body,
apical cell long and narrow | 6 | |
| 2. Species large, 4 mm. and over | 3 | |
| Species small, 3.5 mm. and less | 5 | |
| 3. Vertex broadly rounding, scarcely
longer on middle than at eye. Spe-
cies shining black, elytra truncate..... | | <i>anthracina</i> V. D. |
| Vertex definitely pointed | 4 | |
| 4. Vertex obtusely angled, one-half longer
on middle than at eye, elytra trun-
cate behind, species dark | | <i>uhleri</i> Ball |
| Vertex acutely angled, species straw
colored | | <i>shasta</i> Ball |
| 5. Female segment twice longer than pre-
ceding; vertex always sulphur yel-
low, unmarked | | <i>humida</i> Osb. |
| Female segment slightly longer than
preceding lateral angles acutely pro-
duced, vertex tawny with definite
fuscous markings | | <i>arctostaphyli</i> Ball |
| 6. Elytra extremely long and narrow | 7 | |
| Elytra moderately long | 9 | |
| 7. Vertex distinctly obtusely angled, twice
longer on middle than at eye, elytra
dark | | <i>cornicula</i> Marsh. |
| Vertex broadly rounding, species dark.. | 8 | |
| 8. Vertex one-half longer on middle than
at eye, irregular transverse markings.
Female segment truncate, not form-
ing median tooth | | <i>angustata</i> Osb. |
| Vertex scarcely longer on middle than
at eye, single transverse band. Fe-
male forming dark median obtuse
point | | <i>cuneata</i> S. & DeL. |
| 9. Vertex broadly rounding, species large,
4.5 mm. and over | 10 | |
| Vertex definitely obtusely angled | 13 | |
| 10. Species straw colored, vertex with ir-
regular black spots and transverse
bands | 11 | |

- Species dark with definite transverse bands on vertex 12
11. Vertex and front strongly inflated, twice longer on middle than at eye..... *calvata* Ball
 Vertex not inflated, less than one-half longer on middle than at eye *gentilis* V. D
12. Vertex strongly sloping, one-half longer on middle than at eye, transverse bands interrupted, fuscous, cross-nervures broadly white *vara* Ball
 Vertex not strongly sloping, twice longer on middle than at eye, transverse bands continuous *symphoricarpae* Ball
13. Vertex acutely conical, almost right angled, tawny, with definite fuscous markings *comptoniana* Ball
 Vertex obtusely angled 14
14. Ground color olivaceous or orange with wavy transverse lines on vertex, always confluent at one or more points 15
 Ground color yellow with transverse lines, not wavy, never confluent; elytra yellowish subhyaline *luteola* n. sp.
15. Species with definite olive cast, fore and middle femora twice banded with white *striatula* Fall.
 Species with definite orange cast, fore and middle femora shining black to just before the apex, then abruptly orange as are the tibia *osborni* Ball

Ophiola uhleri Ball (Plates III, VIII, and IX)

Athysanus (Conosanus) uhleri Ball, Can. Ent. 43, p. 200, 1911.

Athysanus (Conosanus) plutonius Osborn and Ball, Rev. Athy., p. 200, 1902.

A broad robust species with bluntly angled vertex, elytra truncate behind. Length 4 mm.

Vertex distinctly angulate, almost twice as long on middle as against eye, one-half as long as broad and three-fourths the length of pronotum. Elytra short and broad, truncate posteriorly, slightly exceeding the abdomen.

Color: Black to yellowish brown, line on posterior margin of vertex, oblique spot against either eye and a pair

medianly near the apex, yellow. Pronotum and scutellum with a few irregular spots. Elytra usually dark, occasionally nervures are creamy.

Genitalia: Female last ventral segment slightly longer than preceding, posterior margin roundly produced, lateral angles bluntly rounded. Male valve bluntly convexly rounding; plates triangular, two and one-half times length of valve, apices blunt, margins thickly clothed with yellow hairs. Internal genitalia distinct and illustrated.

Species dark in color, vertex with varying amount of orange.

A common species in Northwestern United States, extending westward to Colorado and South Dakota, south to Washington, D. C., and northward into Canada. It has been swept from low ground meadows (Osborn).

Type locality Ames, Iowa. Type in Ball collection. Species examined from numerous localities.

Ophiola uhleri var. *speculata* Ball, Bull. Brooklyn Ent. Soc., Vol. XXIII, No. 4, p. 187, 1928.

Resembling *uhleri* in size and form, but of a yellowish brown coloration. Slight markings sometimes present on the vertex. Genitalia identical with *uhleri*, both externally and internally.

Dr. De Long reports sweeping it from a sweet fern association. Type locality Speculator, N. Y. Type in Ball collection.

Ophiola anthracina Van Duzee (Plates III, VIII, and IX)

Athysanus anthracinus Van Duzee, Can. Ent., XXVI, p. 1894.

Resembling *uhleri* in size and form, but darker and distinguished by the shorter, more broadly rounding vertex. Length 4 mm.

Vertex broadly obtusely conical, slightly longer on middle than against eye, two-thirds as long as broad. Pronotum twice longer than vertex. Elytra broad and short, truncate behind, slightly exceeding abdomen.

Color: Shining black, two spots on posterior margin of vertex farther removed from one another than from the eyes. Elytra black, nervures always dark. Front and venter dark.

Genitalia: Female last ventral segment longer than preceding, lateral angles sub-acute, posterior margin slightly roundly produced. Male valve convexly rounding; plates

triangular, two and one-half times as long as valve, apices blunt, lateral margins sparsely clothed with dark hairs.

This species can be readily distinguished from *uhleri* by the short blunt vertex.

Occurs commonly in Northeastern United States, extending as far west as Colorado. It has been reported feeding abundantly on high dry meadows and hillsides in Ohio and Maine by Professor Osborn.

Type localities Iowa, Kansas, and Colorado. Type doubtful, in Agricultural College collection, Ames, Iowa, or in Cornell University collection. A large number of specimens examined from numerous localities in Eastern United States.

Ophiola arctostaphyli Ball (Plates III, VIII, and IX)

Athysanus arctostaphyli Ball, Ent. News, X, p. 172, 1899.

Similar to *striatula* in general appearance, but broader and shorter. Length 3.5 mm.

Vertex bluntly angled, slightly over one-half longer on middle than width between eyes. Pronotum little more than one-fourth longer than vertex. Elytra not exceeding abdomen in length.

Color: Vertex tawny yellow with definite fuscous markings. Transverse line between reddish ocelli, near middle suddenly directed obliquely forward to near apex, posteriorly two irregular transverse lines confluent by a median longitudinal line in middle, again next the eyes. Posterior line broken forward on each side at a point nearer the eyes than the middle, pronotum irregularly marked with fuscous. Scutellum with a pair of fuscous markings in basal angles, pair of bilobed spots on disc. Elytra testaceous, subhyaline, nervures pale, heavily bordered with fuscous. Front tawny with distinct arcs of fuscous, venter brownish with dark.

Genitalia: Female last ventral segment slightly longer than preceding, posterior margin slightly produced, lateral angles acutely produced. Male valve bluntly, convexly rounding; plates triangular, two and one-half times as long as valve.

Occur in mountainous regions and has been collected in Colorado, Maine, New Hampshire and Connecticut. Both nymphs and adults were taken from bearberry in the mountains of Colorado

(Ball). No doubt common on high heath habitats in mountainous regions.

Type locality Rist Cañon, Colorado. Type in Ball collection. Type examined, also specimens from states mentioned previously.

Ophiola humida Osborn (Plates III, VIII, and IX)

Athysanus humidus Osborn, Me. Agr. Exp. Sta., Bull. 238, p. 131, 1915.

In general appearance resembling *arctostaphyli* but more slender and readily distinguished by the longer, more angled, sulphur yellow vertex. Length 3.5 mm.

Vertex obtusely angled, slightly more than twice longer on middle than against eyes. Pronotum one-third longer than vertex. Elytra exceeding abdomen.

Color: Vertex pale sulphur yellow, unmarked. Pronotum and scutellum yellow with faint fuscous markings. Elytra subhyaline, pale testaceous, nervures paler, faintly to darkly bordered with fuscous. Front faintly inscribed. Venter pale.

Genitalia: Female last ventral segment almost three times longer than preceding, lateral angles rounding, not produced, posterior margin almost truncate. Ovipositor distinctly longer than pygofer. Male valve obtusely rounding; plates triangular, three times length of valve, tapering gradually to blunt apices.

A rather uniform sulphur yellow species known only from Maine and Wisconsin. No host plant has been designated, although Professor Osborn reports never to have taken it outside of distinct bog situations.

Type locality Orono, Maine. Type in Osborn collection. Type examined, also specimens from Wisconsin.

Ophiola shasta Ball (Plates III, VIII, and IX)

Athysanus shastus Ball, Ent. News, XXVIII, p. 174, 1916.

Resembling *arctostaphyli*, but larger and with an acutely pointed vertex. Length 4.5-5 mm.

Vertex narrowly acutely produced at apex, two-thirds as long on middle as wide between the eyes, two-thirds as long as pronotum. Elytra distinctly longer than abdomen.

Color: Brownish straw, vertex with dark markings as in *arctostaphyli*, but inclined to fade out in places, the posterior line very faint. Elytra pale brownish hyaline,

nervures pale, lightly margined with fuscous. Front light with a few arcs of dark, sutures dark. Venter light as are the legs.

Genitalia: Female last ventral segment slightly longer than preceding, truncate, lateral margins produced, subacute. Male valve obtusely rounding; plates triangular, two and one-half times as long as valves, apices blunt.

This species was described from specimens collected from Dunsuir, California, and since collected at Castella and Colfax, California. Type in Ball collection. Specimens examined from Castella and Colfax, California.

Ophiola gentilis Van Duzee (Plates III, VIII, and IX)

Euscelis gentilis Van Duzee, Proc. Calif. Acad. Sci., Vol. XIV, No. 17, p. 420, 1925.

A large straw colored species with a round black spot just back of each ocellus.

Vertex broad and short, rounding, two and one-half times as wide as long, one-half longer on middle than at eye. Pronotum twice as long as vertex. Elytra definitely longer than body.

Color: Straw yellow, vertex with three reddish brown transverse bands, the median merging into a round black spot just back of each ocellus. Elytra straw color, nervures pale, lightly margined with brown. Front pale straw with fuscous arcs. Venter light.

Genitalia: Female last ventral segment slightly longer than preceding, lateral angles produced and prominent, acute, posterior margin slightly, broadly, roundly produced.

The only records for this species are from California, Oregon, and Montana. Nothing is known regarding its food plant.

Type locality Hobergs Resort, Lake County, California. Type in the Museum of the California Academy of Science. Specimens examined from Le Grand, Oregon.

Ophiola finitima Van Duzee

Euscelis finitimus Van Duzee, Proc. Calif. Acad. Sci., Vol. XIV, No. 17, p. 422, 1925.

The following is the original description: "Head little wider than pronotum, obtusely angled; vertex nearly flat, about two-thirds wider than long; front broad, its length and

width sub-equal, sides straight above, incurved to clypeus, abruptly raised above level of cheeks; clypeus oblong, a little narrowed to the rounded apex; pronotum long, twice as long as vertex, sides broadly rounded behind the eyes; elytra shaped much as in *Eutettix suboenea*, with arcuate costa and flaring tips, with four or five supernumerary veinlets in outer areole of clavus. Last ventral segment of female broadly excavated, the outer angles subacute, middle with a broad short lobate tooth which is feebly angled; pygofers short and broad. Valve of male short, broad, triangular and convex, a little shorter than the pygofers.

Color: Light fulvous brown, clearer beneath, polished; vertex with an angular black mark on each side between ocellus and eye, but showing a tendency to being drawn out into a transverse band; anterior to these spots are two curved darker lines either side the middle and another indicated near the hind margin. Pronotum irrorate with pale, with a large pale area behind the eyes; elytral nervures, except the marginal, pale; minute points at base of tibial spines and claws black."

This species was not available for examination but from the description it undoubtedly belongs in the *Ophiola* group. Dr. Ball has recently placed this species as a color variety of *gentilis* but according to Van Duzee, "they are absolutely distinct, especially in the male genital characters. The females are harder to distinguish but the vertex is much shorter in *gentilis* and there are other differences that make them recognizable."

Ophiola calvata Ball (Plates III, VIII, and IX)

Athysanus calvatus Ball, Can. Ent., XXVII, p. 5, 1901.

A brownish yellow species with a broadly rounded and inflated vertex. Length 4.5 mm.

Vertex broadly rounding, strongly inflated, one-half as long on middle as wide between the eyes. Pronotum twice longer than vertex. Elytra distinctly longer than abdomen.

Color: Vertex brownish yellow, faint transverse lines anteriorly, a pair of dark spots against either eye, often elongated transversely. Pronotum and scutellum dirty straw washed with yellow. Elytra straw colored, sub-hyaline, nervures paler, lightly margined with fuscous. Front bright straw with patches of dark brown.

Genitalia: Female last ventral segment slightly longer than preceding, lateral margins bluntly produced, posterior

margin slightly concavely excavated either side a produced median rounding lobe. Male valve broadly rounding, semi-circular; plates triangular, two and one-half times as long as valve, apices bluntly acute, heavily clothed with hairs.

The strongly inflated, broadly rounding vertex gives this species a unique appearance and distinguishes it from all others in this group.

This species was described from specimens collected at Richfield and Logan, Utah, and since reported from Western Colorado (Ball) and Idaho (Haegele). Nothing is known regarding its food plant.

Type locality Richfield and Logan, Utah. Type in Ball collection. Specimens examined from type localities and Idaho.

Ophiola cornicula Marshall (Plates III, VIII, and IX)

Jassus corniculus Marshall, Ent. M. Mag., II and III, pp. 198-199, 1866.

Jassus orichalceus Thomson, Opusc. Ent. 1, pp. 56-72, 1869.

Jassus plutonius Uhler, Bull. U. S. Geol. Survey, III, p. 470, 1877.

Athysanus instabilis Van Duzee, Can. Ent., XXV, p. 284, 1893.

Athysanus elongatus Osborn, Maine Agr. Exp. Sta. Bull., 238, p. 129, 1915.

Resembling *arctostaphyli* in color and markings but much narrower and the elytra greatly exceeding the abdomen. Apical cells greatly elongated. Length 4.5 mm.

Vertex distinctly angled, much more than one-half longer on middle than width between eyes. Pronotum one and one-half times longer than vertex. Elytra greatly exceeding abdomen.

Color: Ocelli red, vertex pale dirty yellow with three dark transverse lines as in *arctostaphyli*, heavier, the posterior one broken forward touching the median near either eye. Pronotum and scutellum heavily marked with dark. Front dark with faint arcs of yellow. Elytra testaceous, sub-hyaline, nervures pale heavily margined with fuscous. Legs and venter dark.

Genitalia: Female last ventral segment one-half longer than preceding, lateral angles bluntly produced, posterior margin slightly roundly produced. Male valve bluntly convexly rounding; plates triangular, two and one-half times longer than valve, tips blunt.

The writer has compared European examples of *Athysanus corniculus* from Dr. China with American examples of *Athysanus plutonius* Uhl. and can find no character by which they can be separated.

This species is common to the New England states and reported as far south as New Jersey. It is undoubtedly widely distributed over Northeastern United States, occurring in swampy and marshy areas where it perhaps feeds on some heath plant. Professor Osborn reported it on blueberry (Maine).

Numerous specimens were examined from England, New Jersey, Maine, Ontario, New York, and Connecticut.

Ophiola angustata Osborn (Plates III, VIII, and IX)

Athysanus angustatus Osborn, Me. Agr. Exp. Sta. Bull., 238, p. 130, 1915.

In general appearance resembling *cornicula*, but smaller and with a shorter, more rounding vertex. Genitalia distinct. Length 4 mm.

Vertex broadly rounding, less than one-half as long on middle as wide between the eyes. Pronotum twice longer than vertex. Elytra greatly exceeding abdomen.

Color: Vertex greenish yellow with more or less irregular fuscous markings. Elytra brownish to yellowish hyaline, nervures pale, faintly to distinctly bordered with fuscous. Front yellowish with several arcs of dark, clypeus and lorae yellow, sutures dark. Venter dark except lateral margins, which are yellow as are the pygofers.

Genitalia: Female last ventral segment equal to preceding, posterior margin almost truncate behind, lateral angles very blunt, not produced. Male valve short, broadly rounding, twice longer than last ventral segment; plates triangular, three times longer than valve, tips blunt.

This species was described from specimens taken in Maine and since collected from Cranberry Lake, New York (Osborn) and Lake Placid, N. Y. (Van Duzee). Practically nothing is known regarding its food plant, although it undoubtedly feeds on some swamp plant.

Type locality Maine. Type in Osborn collection. Type examined, also numerous specimens from Maine and New York.

Ophiola cuneata Sanders and De Long (Plates III, VIII and IX)

Euscelis cuneatus Sanders and De Long, Bull. Bur. Plant Industry, Penna., Vol. III, No. 15, p. 17, 1920.

Shorter and more wedge shaped behind than *angustata*

with a broad black band on vertex and with distinct genitalia.

Vertex slightly roundly produced, almost parallel margined, half as long as wide between the eyes, slightly over one-half as long as pronotum. Elytra distinctly longer than pronotum.

Color: Vertex, pronotum, and scutellum greenish yellow. Vertex with black transverse band between eyes just back of ocelli. Elytra smoky subhyaline, nervures with yellowish tint. Front dark with several arcs of yellow, spot on clypeus, sutures, dark. Venter black except ventral lateral thirds of last segment. Ovipositor black.

Genitalia: Female last ventral segment slightly longer than preceding, lateral angles pointed, posterior margin strongly concavely hollowed either side of a dark, median obtuse tooth. Male valve short, broadly rounding; plates triangular, three and a half times longer than valve, enlarged at base, tapering gradually to acute tips.

In both external and internal genitalia as well as other structural characters, this species appears to belong in this group, although formerly placed with *striolus*.

Present records indicate its distribution east of the Alleghenies, in Ohio and North Carolina. It doubtless is more widely distributed than collecting records would indicate as it is easily confused with the small form of *striolus*. De Long reports sweeping it from *Juncus*, small sedges, and *Cyperus diandrus* at Presque Isle, Pa.

Type locality Presque Isle, Pa. Type in Sanders and De Long collection. Specimens examined from Pennsylvania, New Jersey, New York and Ohio.

Ophiola symphoricarpae Ball (Plate III)

Athysanus symphoricarpae Ball, Can. Ent., XXXIII, p. 5, 1901.

Form of *striatula* but longer, more robust and with a rounding vertex. Length 4.5 mm.

Vertex broadly rounding, twice as wide between the eyes as long on middle. Pronotum twice as broad as long. Elytra longer than abdomen.

Color: Ocelli blood red, vertex pale testaceous with reddish transverse bands as in *striatula*. Pronotum and scutellum testaceous. Elytra testaceous subhyaline, nervures paler, lightly margined with fuscous. Front pale with remnants of eight pairs of dark arcs. Legs and venter pale straw.

Genitalia: Female last ventral segment slightly longer than preceding, lateral angles rounding, posterior margin almost truncate behind.

No male of this species was available for examination.

Described from specimens collected from Colorado and not since reported. Dr. Ball has designated *Symphoricarpos* as its food plant.

Type locality Ridgeway, Colorado. Type in Ball collection. Type examined.

Ophiola vara Ball (Plates III, VIII, and IX)

Athysanus varus Ball, Can. Ent., XXXIII, p. 5, 1901.

Resembling *symphoricarpae* in form and appearance but with a distinct color pattern. Length 4.5–5 mm.

Vertex obtuse, rounded sloping apex, one-half as long as width between eyes, twice as long on middle as against eyes. Pronotum one-third longer than vertex. Elytra exceeding abdomen.

Color: Vertex yellow washed with orange, a transverse band just back of ocelli, an interrupted one anteriorly and between ocelli, another close to posterior margin, fuscous. Pronotum irrorate with fuscous, scutellum with a pair of median tri-lobed spots. Elytral nervures pale, especially cross nervures, more or less margined with fuscous, cells irregularly fuscous. Front pale yellow with irregular ares, spot at apex of clypeus, fuscous. Sutures dark. Venter dark.

Genitalia: Female last ventral segment half longer than preceding, lateral angles rounding, posterior margin truncate. Male valve nearly semicircular; plates long, triangular, three times length of valve, apices sub-acute, lateral margins slightly concave.

Described from specimens collected at Fort Collins, Colorado, and not since reported. Its food plant is as yet unknown.

Type locality Fort Collins, Colorado. Type in Ball collection. Specimens examined from type locality.

Although Dr. Ball has recently placed this species in the genus *Euscelis*, the writer believes it to be more closely related to the *Ophiola* group. The narrow and elongated appearance and the color pattern in the form of transverse bars on the vertex suggest *Ophiola*. Also, there is apparently a much closer correlation of the internal genital structures of this species with the external structures of the *Ophiola* group than with those of the *Euscelis* group.

When the host plant has been definitely determined this species should be placed with greater certainty.

Ophiola striatula Fallén (Plates III, VIII, and IX)

Cicada striatula Fallén, Hem. Suec., Cicad., p. 45, 1926.

Athysanus striatulus Fallén, (or *vaccinii* Van Duzee), Ent. Amer., VI, p. 134, 1890.

Euscelis vaccinii Van Duzee, Cat., p. 659, 1917.

An olivaceous yellow species common to both Europe and North America.

Vertex obtusely angled, one-half as long on middle as wide between the eyes, two-thirds as long as pronotum. Elytra narrow and distinctly longer than abdomen.

Color: Vertex olivaceous yellow with definite markings as in *arctostaphyli*. Elytra testaceous subhyaline, nervures whitish with olive tint, heavily margined with fuscous. Front dark with faint ares of olive yellow. Legs pale. Venter dirty yellow.

Genitalia: Female last ventral segment slightly longer than preceding, lateral angles produced, bluntly acute, posterior margin slightly roundly produced. Male valve broadly convexly rounding; plates triangular two and one-half times longer than valve, apices blunt.

Species extremely variable in size and coloration. The markings may be distinct, faint, or entirely lacking. The legs may be twice annulate with pale or entirely pale. The elytral nervures may be heavily, lightly, or not at all margined with fuscous. The genital characters are constant, specific internally but not externally. American forms compared with European forms with which they agree.

A species common to both Europe and North America. Its distribution extends from Maine westward to Iowa and Colorado, south to New Jersey and Maryland, northward into Ontario. Occurs in the *vaccinium* bogs of Northeastern United States and the higher meadows of the Rocky Mountains.

Type probably in Stockholm Museum. A great many specimens were examined from numerous diverse localities.

Ophiola striatula var. *cacheola* Ball

Ball, Bull. Brooklyn Ent. Soc., Vol. XXIII, No. 4, p. 189, 1929.

The following is the original description: "Resembling *striatula* in form and structure but much darker. Shining

black with seven spots in two transverse rows on vertex, three in front and four behind. Six irregular spots on the anterior submargin together with numerous dots on the disc of the pronotum, white. The apices of the claval nervures, the cross nervure between sectors and sometimes the adjoining nervures, white. Face and below black. A few dots on lower part of face and the apices of the anterior and middle femora yellow."

Type locality top of Wasatch Range near Logan, Utah. Type in Ball collection.

No example was available for examination.

Ophiola osborni Ball (Plates III, VIII, and IX)

Ball, Brooklyn Ent. Soc., Vol. XXIII, No. 4, p. 190, 1928.

Form and general appearance of *symphoricarpae* but slightly smaller and darker in color. Length 4-4.5 mm.

Vertex one-half as long on middle as wide between eyes. Pronotum twice as long as vertex.

Color: Ocelli blood red, vertex with reddish tint and with definite markings as in *symphoricarpae*. Elytra testaceous, subhyaline, nervures pale, heavily bordered with fuscous. Front dark with faint arcs of orange. Femora usually dark to near the apices, then orange as are the tibia. Venter dark as are the pygofers.

Genitalia: Female last ventral segment slightly longer than preceding, lateral angles bluntly rounding, posterior margin slightly roundly produced. Male valve obtusely rounding; plates triangular, two and one-half times longer than valve, apices blunt.

Common on the dry uplands of Northeastern United States, extending from Maine westward to Montana and Colorado, southward to Maryland and northward into Ontario. Nothing is known regarding the food plant.

Type locality Ames, Iowa. Type in Ball collection. Numerous specimens from many states were examined.

Ophiola luteola n. sp. (Plates III, VIII, and IX)

In size and form resembling *striatula* but with greenish hyaline elytra and distinct genitalia. Length 4.5-5 mm.

Vertex obtusely angled, one-half as long on middle as wide between the eyes. Pronotum twice as broad as long. Elytra exceeding abdomen.

Color: Vertex bright greenish yellow with three transverse bands, the two posterior ones faint and more or less interrupted. Elytra greenish, nervures pale. Front pale yellow with about eight arcs of dark fuscous, sutures dark. Venter dark, except last two segments in female, yellow. Legs pale. Male without markings.

Genitalia: Female last ventral segment one-half longer than preceding, posterior margin slightly roundly produced, lateral angles strongly acutely produced. Male valve obtusely triangular; plates triangular, two and one-half times longer than valve, tips acute.

Described from one female and one male collected at Wareham, Mass., and now in collection of Dr. D. M. De Long.

Ophiola comptoniana Ball (Plates III, VIII, and IX)

Ball, Brooklyn Ent. Soc., Vol. XXIII, No. 4, p. 189, 1928.

Resembling *striatula* in size and color pattern but distinguished by the much more angled vertex. Length 4.5 mm.

Vertex distinctly angled, almost right angled, two-thirds as long as wide between the eyes, twice as long on middle as against eyes. Pronotum almost one-half longer than vertex. Elytra distinctly longer than abdomen.

Color: Vertex olive yellowish with definite fuscous markings as in *striatulus*, paler. Pronotum and scutellum yellowish with irregular markings of fuscous. Elytra tawny, nervures pale, lightly margined with fuscous. Front tawny with pale arcs of yellow. Sutures dark. Venter and legs pale dirty yellow.

Genitalia: Female last ventral segment long as preceding, posterior angles slightly acutely produced, posterior margin almost truncate. Male valve rounding; plates triangular, two and one-half times longer than valve, tips blunt.

Described from specimens collected at Roselle Park, New Jersey. It has also been collected in Pennsylvania (Sanders). Ball reports collecting both adults and nymphs from *Comptonia peregrinus* (sweet fern).

Type locality Roselle Park, New Jersey. Type in Ball collection. Specimens examined from type locality, also from New York and Pennsylvania.

Genus *Commellus* Osborn and Ball

Plates I, VI, and IX

Commellus Osborn and Ball, Ohio Nat., II, p. 245, 1902.

Vertex produced in front of eyes, flattened above, acutely angled with front, not conical. Elytra slightly shorter or distinctly longer than abdomen. Venation irregular, second cross nervure often present. Form broad and stout.

Type of genus *Athysanus comma* Van Duzee.

Species conspicuously marked with longitudinal stripes. Female segment always deeply excavated, incised at apex and with underlying membrane conspicuous. Apices of male plates very broad.

KEY TO SPECIES OF *Commellus*

- | | |
|--|--------------------------|
| 1. Two pairs of spots common to vertex and front, stripes on pronotum, black. Venation of elytra obscure..... | 2 |
| One pair of spots common to vertex and front, stripes on pronotum indistinct and interrupted, venation of elytra distinct..... | <i>sexvittatus</i> V. D. |
| 2. Elytra with four separate stripes..... | <i>comma</i> V. D. |
| Elytra with eight separate stripes..... | <i>colon</i> O. & B. |

Commellus comma Van Duzee (Plates I, VI, and IX)

Athysanus comma Van Duzee, Can. Ent., XXIV, p. 114, 1892.

A broad stout species, creamy white with fulvous brown markings. Length 4.5-5 mm.

Vertex obtusely angular, margin thick, rounding to broad front, two-thirds as long on middle as wide between the eyes, almost as long as pronotum. Frontal suture distant from the eyes, sides narrowing regularly to clypeus. Elytra exceeding or shorter than the abdomen.

Color: Pale creamy, four spots equally on vertex and face, a pair at base of vertex, black; pronotum and scutellum with four parallel longitudinal black stripes. Elytra creamy, a broad fulvous brown band extending around within margins, broader behind, bifurcating anteriorly to become confluent with stripes on pronotum, a broad brown band on claval suture and another, narrower, on inner branch of first sector. Front pale with a pair of spots below antennae and another pair on lateral margins of pronotum. Legs and venter pale.

Genitalia: Female last ventral segment distinctly longer than preceding, obliquely sloping on lateral margins, posterior margin deeply concavely excavated, dark margined apical slit, underlying membrane exposed at apex. Male valve large, triangular; plates twice longer than valve, convexly rounding at base, narrowing to middle, then parallel margined to broad truncate apices, equaling the pygofer. Internal genitalia distinct and illustrated.

This species is known to occur in Iowa, Nebraska, Kansas, Colorado, New Hampshire, and New York. Its host plants according to Osborn and Ball are *Elymus canadensis* and *E. striatus*. It has also been reported on Buffalo grass (De Long).

Type locality Iowa. Type doubtful, in Agricultural College collection, Ames, Iowa, or in Cornell University collection. Numerous specimens examined from Iowa, New York and Nebraska.

Commellus colon Osborn and Ball (Plates I, VI, and IX)

Athysanus colon Osborn and Ball, Proc. Ia. Acad. Sci., IV, p. 223, 1897.

Similar to *comma* but elytra with different color pattern and venation. Length 4.5–5 mm.

Vertex obtusely angular, two-thirds as long on middle as wide between eyes, almost as long as pronotum. Inner branch first sector forking again to form long antepical cell.

Color: Vertex, pronotum, and scutellum with spots and stripes as in *comma*; elytra with eight fulvous brown stripes. A continuous stripe just outside the first sector, one near the claval suture, and another median in the clavus, confluent with the outer stripe on the pronotum, a stripe between branches of first sector, a short stripe between branches of its inner fork, an interrupted one between the first and second sectors, one on the outer apical half of the clavus and another on the basal half, confluent with inner stripe on pronotum.

Genitalia: Posterior margin of female segment more deeply excavated than in *comma*, pygofer distinctly longer than plates. Internal genitalia distinct and illustrated.

The eight reddish-brown stripes on each elytron appears to be a good and constant character for separating this species from *comma*.

Occurs commonly on the prairies of Iowa and southern Minnesota where Osborn and Ball report taking it from *Stipa spartea*.

Type locality Ames, Iowa. Type in the Agricultural College collection, Ames, Iowa. Type examined, also numerous specimens from type locality.

Commellus sexvittatus Van Duzee (Plates I, VI, and IX)

Athysanus sexvittatus Van Duzee, Can. Ent., XXVI, p. 93, 1894.

In form and structure similar to *comma* and *colon*, but distinguished by color and wing venation. Brachypterous form. Length 4 mm.

Vertex obtusely angular, slightly wider between the eyes than long on the middle, as long as pronotum. Venation of elytra irregular, two or more cross nervures between sectors and usually two anteapical cells.

Color: Rusty yellow, vertex with a pair of shining black spots on apex, two pairs of quadrate spots posterior to these, tendency to become confluent, dull brown, six faint, irregular stripes on pronotum, the two median ones extending onto the scutellum. Elytra brownish subhyaline, nervures broadly pale, usually distinct, irregularly margined with fuscous. Front pale fuscous with faint arcs of yellow, sutures dark, legs and venter pale with light fuscous markings.

Genitalia: Female last ventral segment longer than preceding, posterior margin deeply excavated and incised at apex as in *colon*, exposing triangular lobe of underlying membrane. Male genitalia as in *comma* and *colon*. Inter-nal genitalia distinct, illustrated.

Described from specimens collected from Colorado and since collected from Kalispell, Montana (Osborn), where it was swept from a tall red-top grass in rocky broken areas.

Type locality Colorado. Type doubtful, in Agricultural College collection, Ames, Iowa, or in Cornell University collection. Specimens examined from type locality and Montana.

Genus *Stirellus* Osborn and Ball

Plates IV, VI, and IX

Stirellus Osborn and Ball, Ohio Nat., II, p. 250, 1902.

Vertex conically produced, narrow, longer on middle than width between eyes, disc convex, sloping and merging indistinctly with front. Species small. Elytra broad and short, venation simple. Ovipositor exceeding pygofers.

Type of genus *Athysanus bicolor* Van Duzee.

KEY TO SPECIES OF *Stirellus*

- | | | |
|--|---|--------------------------|
| 1. Male plates little longer than valve, apices broad and very blunt, almost truncate.. | 2 | |
| Male plates more than twice longer than valve, apices narrow and rounding, not truncate | | <i>mexicanus</i> O. & B. |
| 2. Species greenish, large pair of dark spots on vertex, elytra with apical veins not distinct | | <i>bicolor</i> V. D. |
| Species brownish, 4 small spots on vertex, elytra with apical veins distinct and margined with dark fuscous..... | | <i>obtusus</i> V. D. |

Stirellus bicolor Van Duzee (Plates IV, VI, and IX)

Athysanus bicolor Van Duzee, Can. Ent., XXIV, p. 114, 1892.

Similar to *obtusus* in size and general appearance, but with different color pattern and distinct genitalia. Length 3-3.4 mm.

Vertex acutely conically pointed, as long on middle as width between eyes. Elytra broad and short, rounding behind. Ovipositor greatly exceeding pygofers.

Color: Quite variable, vertex greenish yellow, a pair of black spots before middle, often confluent and covering anterior half, more often in male than female. Pronotum with dark band on anterior part, extending across base of elytra. Elytra bright greenish yellow to pale, with sutural margins, claval sutures, and apical margin dark fuscous. In male elytra often entirely fuscous, nervures indistinct. Front dark above with light band across lower half and base of clypeus. Venter dark.

Genitalia: Female last ventral segment as long as preceding, lateral margins, broadly rounding, posterior margin shallowly excavated, ovipositor greatly exceeding pygofers. Male valve triangular; plates but little exceeding the valve, convexly rounded to broad blunt apices, together almost semicircular, margins clothed with hairs.

A common meadow species, especially in southern localities, distributed from New Jersey and Maryland westward to Iowa, Kansas, and Nebraska, and southward into Cuba, Mexico, and Brazil. Osborn and Ball report it occurring normally on *Andropogon scoparius* but it undoubtedly occurs on a wide range of meadow grasses.

Type localities Mississippi and Emporia, Kansas. Type doubtful, in Agricultural College collection, Ames, Iowa, or in Cornell University collection.

Numerous specimens examined from many localities, including Mexico and Cuba.

Stirellus obtutus Van Duzee (Plates IV, VI, and IX)

Athysanus obtutus Van Duzee, Can. Ent., XXIV, p. 115, 1892.

In size and form similar to *bicolor* but testaceous in color and with a different pattern. Length 3-3.5 mm.

Vertex angled, as long on middle as width at base. Elytra broad and short, rounding behind.

Color: Vertex pale testaceous with four spots between eyes, anterior pair often darker and larger than the posterior pair. Pronotum testaceous with a row of irregular spots on anterior margin, often confluent in a more or less transverse band. Elytra testaceous subhyaline, nervures pale. Face testaceous, often dark above, apex of clypeus dark fuscous.

Genitalia: Female last ventral segment scarcely as long as preceding, lateral angles rounding, posterior margin shallowly excavated, ovipositor greatly exceeding pygofers. Male valve triangular; plates convexly rounded, almost semicircular, but little exceeding valve.

A species widely distributed from Maryland as far west as Arizona and southward to the Gulf states. It occurs commonly in meadows, more abundantly on *Andropogon scoparius*. Professor Osborn also reports its feeding on Bermuda grass. There are probably three generations a year, the last one hibernating as an adult.

Type locality Mississippi. Type doubtful, in Agricultural College collection, Ames, Iowa, or in Cornell University collection.

A great number of specimens from diverse localities examined.

Stirellus mexicanus Osborn and Ball (Plates IV, VI, and IX)

Stirellus mexicanus (Osborn and Ball) Ohio Naturalist, Vol. II, p. 254, 1902.

Form of *obtutus* and *bicolor* but with male genital plates triangular in shape, not semicircular.

Vertex narrow, slightly longer than its basal width. Elytra long, reaching tips of the exerted ovipositor.

Color: Vertex yellow with pair of large black spots, often confluent in male. Pronotum and elytra greenish to yellowish brown. Face pale to dark with ares of yellow.

Genitalia: Female last ventral segment long, ovipositor longer than in *bicolor*. Male valve triangular, apex acute. Plates triangular, apices rounding, over twice as long as valve.

This species has not yet been reported north of Mexico.

Type locality Orizaba, U. C. Mexico. Type in Herbert Osborn collection. Type examined.

Genus *Amplicephalus* De Long
Plates V and X

Amplicephalus De Long, Ohio State Univ. Bull. II, No. 13, p. 83, 1926.

Vertex very broad, width between eyes greatly exceeding length at middle, strongly rounded or very bluntly angled. Margin bluntly angled with front. Form broad and robust. Anteapical cell constricted and usually divided.

Type of genus *osborni* Van Duzee.

KEY TO SPECIES OF *Amplicephalus*

- | | |
|--|------------------------|
| 1. Vertex broadly bluntly angled..... | <i>simplex</i> V. D. |
| Vertex very broad, scarcely angled..... | 2 |
| 2. Female segment narrowly incised at middle,
vertex with dark spot next either eye and
a pair of elongated spots between these..... | <i>escalantus</i> Ball |
| Female segment not incised at middle..... | 3 |
| 3. Female segment with short lateral margins,
underlying membrane conspicuous at
sides; male plates triangular with tips
pointed | 4 |
| Female segment normal, underlying mem-
brane not conspicuous at sides; male
plates concavely rounding to very broad
blunt apices; broad black band on ante-
rior margin of vertex..... | <i>estacadus</i> Ball |
| 4. Vertex, pronotum, and scutellum each with a
pair of dark round spots in line..... | <i>lassus</i> Ball |
| Vertex scarcely produced with four or six
spots on anterior margin..... | <i>osborni</i> V. D. |

Amplicephalus simplex Van Duzee (Plates V and X)

Deltocephalus simplex Van Duzee, Trans. Am. Ent. Soc., XIX, p. 304, 1892.

Athysanus simplarius Osborn and Ball, Ohio Nat., II, p. 249, 1902 (n. n. for *simplex* V. D.).

Deltocephalus (*Amplicephalus*) *simplex* De Long, O. S. U. Bull., Vol. II, No. 13, p. 83, 1926.

Amplicephalus simplex De Long and Slesman, Ann. Ent. Soc. Am., Vol. XXII, No. 1, p. 96, 97, 1929.

Vertex bluntly angled, almost twice as long on middle as against eye, one-fourth broader than long, slightly shorter than pronotum. Elytra exceeding abdomen. Length 4-5 mm.

Color: Vertex straw yellow, often greenish yellow, a pair of approximate triangular spots at apex, a quadrate pair next either ocellus, black. Pronotum pale yellow, often pale greenish, unmarked. Elytra pale greenish yellow, nervures paler. Face straw colored with light brownish arcs. Venter straw yellow, ovipositor black.

Genitalia: Female last ventral segment as long as preceding. Lateral margins short, abruptly concavely rounded to posterior margin, exposing underlying membrane at sides. Posterior margin slightly concave and notched either side a short, blunt triangular median tooth. Male valve short, broadly rounding; plates three times as long as valve, broad at base, outer margins strongly concavely rounded to acute tips.

Distributed along the Atlantic coast from Connecticut to lower Virginia. Collected from Virginia on *Spartina patens* in a salt marsh (De Long).

Type localities Canton Marsh, Md., Astoria, L. I., and Hoboken, N. J. Type in Agricultural College collection, Ames, Iowa. Specimens examined from several localities.

Amplicephalus osborni Van Duzee (Plates V and X)

Deltocephalus osborni Van Duzee, Trans. Am. Ent. Soc., XIX, p. 304, 1892.

Athysanus osborni Osborn and Ball, Proc. Ia. Acad. Sci., IV, p. 220, 1897.

Deltocephalus (*Amplicephalus*) *osborni* De Long, O. S. U. Bull., Vol. II, No. 13, p. 84, 1926.

Amplicephalus osborni De Long and Slesman, Ann. Ent. Soc. Am., Vol. XXII, No. 1, p. 96-97, 1929.

Vertex roundly obtusely angled, two-thirds as long as wide between the eyes, pronotum almost as long as vertex,

twice wider than long. Elytra exceeding abdomen, inclined to be flaring behind.

Color: Pale straw yellow, tawny, with varied markings, often indistinct. Vertex usually with four dark spots on anterior margin. Median pair longer and often confluent with those next the ocelli. Pronotum tawny with traces of five pale longitudinal bands. Elytra pale dirty yellow, nervures white, often margined with fuscous. Face pale with traces of light ares. Venter straw yellow.

Genitalia: Female last ventral segment as long as preceding, lateral margins short, abruptly concavely rounded to posterior margins, exposing lobes of underlying membrane at sides. Posterior margin bisinuate, forming three rounding lobes, the median shorter. Male valve short, broadly rounding; plates triangular, three times as long as valve, gradually tapering to acute tips.

This species is widely distributed throughout Northeastern United States, extending from Maine to Colorado, Missouri, and Nebraska and almost as far south as the Ohio River. It occurs more abundantly in the Northern States.

No definite food plant is known, but it is common on tall grasses and sedges in marshy areas of the *Calamagrostis* meadow where a swamp or lagoon has receded (De Long).

Type locality Lancaster, New York. Type in Agricultural College collection, Ames, Iowa. Specimens examined from numerous localities.

Amplicephalus lassus Ball (Plates V and X)

Athysanus lassus Ball, Ent. News, XXVII, p. 175, 1916.

A rather robust brownish species distinguished by a pair of dark brown spots on vertex, pronotum and scutellum. Length 4 mm.

Vertex obtusely angled, slightly over one-half as long as basal width. Pronotum one-half as long as wide. Elytra exceeding abdomen.

Color: Vertex brownish yellow, a pair of small dots on apex, a pair of large round spots between these and ocelli, brown. Pronotum and scutellum each with a pair of brown spots on anterior margins. Elytra milky hyaline, nervures pale, occasionally claval and apical nervures lightly margined with fuscous. Face and venter pale.

Genitalia: Female last ventral segment length of preceding, lateral margin very short, concavely produced to

posterior margin which is bisinuate, forming three broadly rounding lobes. Male valve obtusely rounding; plates triangular, outer margins slightly concave, tapering to acutely attenuated tips.

This species was described from Quincy, California, and since collected from Montana and Wyoming (Osborn). Nothing is known regarding its host plant.

Type locality Quincy, California. Type in Ball collection. Specimens examined from Montana and Wyoming.

Amplicephalus estacadus Ball (Plates V and X)

Athysanus estacadus Ball, Can. Ent., XLIII, p. 200, 1911.

Euscelis ozarcensis Gibson, Can. Ent., 42, p. 184, 1917.

A robust dark straw-colored species with a dark transverse submarginal band on vertex.

Vertex two-thirds as long on middle as wide between the eyes, obtusely angular.

Color: Vertex bright straw, a broad black band just back of anterior margin. Pronotum with a light, narrow, median transverse band. Elytra dark straw with light margins, nervures pale. Front fuscous with ares of pale brownish yellow, sutures dark. Legs and venter dark with areas of pale fuscous.

Genitalia: Female segment twice longer than preceding, lateral margins rounding to the produced posterior margin. Male valve broadly convexly rounding; plates triangular, broad at base, convexly rounding to near middle, then concave, gradually narrowing to acute tips.

Described from Texas but it undoubtedly has a much wider distribution. It has been reported from Tennessee where it occurs abundantly on native grasses (De Long) and from Missouri (Gibson). *Euscelis ozarcensis* = *Amplicephalus estacadus* as Dr. Ball has recently pointed out.

Type locality Texas. Type in Ball collection. Specimens examined from type locality, also numerous specimens from Tennessee.

Amplicephalus escalantus Ball (Plate V)

Athysanus escalantus Ball, Ent. News, XXVII, p. 175, 1916.

Deltocephalus escalantus Van Duzee, Cat., p. 649, 1917.

Vertex obtusely angled, two-thirds as long as width between eyes. Pronotum twice as broad as long. Elytra only slightly exceeding pygofers.

Color: Vertex yellow washed with orange, a small submarginal spot against either eye, between these a narrow black band broken medianly. Elytra greenish subhyaline, nervures pale. Face pale straw with anterior margins and lateral sutures dark. Venter dark.

Genitalia: Female last ventral segment half longer than preceding, lateral angles subacute, posterior margin almost truncate, slightly excavated on median third, shallowly incised at apex.

Described from specimens collected from Richfield, Utah; and since collected from Yellowstone National Park by Professor Osborn.

Type locality Richfield, Utah. Type in Ball collection. Specimens examined from localities previously mentioned.

Genus *Amblysellus* Nov.

Plates IV, VI, and X

Vertex nearly right-angled, slightly wider between eyes than length on middle. Front broad at apex, triangular, narrowing regularly to the long clypeus. Elytra broad and short.

Type of the genus *Athysanus curtisii* Fitch.

Amblysellus curtisii Fitch (Plates, IV, VI, and X)

Amblycephalus curtisii Fitch, Homop. N. Y. State Cab., p. 81, 1851.

A small greenish yellow species distinguished by the angular vertex and the "Y" shaped figure on clypeus. Length 3.5 mm.

Vertex angular, almost right-angled, as long as width between eyes, twice as long on middle as against eyes. Elytra broad and short, not greatly longer than body.

Color: Vertex pale yellowish green, usually a pair of small black spots on apex, a pair of large shining spots between and a little in front of eyes, black. Anterior part of pronotum produced between the eyes, shining black, posterior part greenish yellow, narrowly margined with fuscous behind. Elytra testaceous, the margins and nervures greenish yellow. Front with irregular fuscous markings on apex,

margins below eyes fuscous, joining a median mark on the clypeus, forming a "Y"-shaped figure. Venter dark.

Genitalia: Female segment longer than preceding, lateral margins roundly narrowed, forming rounded lateral angles. Posterior margin slightly excavated either side a short rounded median lobe. Lobes of underlying membrane exposed at sides. Male valve roundly triangular; plates triangular two and one-half times length of valve, tips acute, fringed with hairs.

A species widely distributed in Northeastern United States, extending southward to New Jersey and Tennessee and westward to Iowa and Missouri. It is common in blue grass meadows and grass woodlands where it rivals *D. sayi* in abundance.

Numerous specimens examined from a great many localities.

SPECIES REFERRED TO OTHER GENERA

Thamnotettix texanus Osborn and Ball (Plates V and X)

Athysanus texanus Osborn and Ball, Proc. Dav. Acad. Sci., VII, p. 92, 1898.

In size and form similar to *Th. fitchii* but distinguished by a pair of parallel, bright red stripes on the vertex, pronotum, and scutellum and distinct genital characters. Length, female 5 mm., male 4 mm.

Vertex obtusely angled, slightly longer on middle than width between eyes. Elytra exceeding abdomen.

Color: Vertex pale yellow, a narrow black line on anterior margin, a pair of black spots near apex and a pair of broad, longitudinal, bright red stripes running parallel on vertex, pronotum, and scutellum. Three pairs of red stripes on elytra, the inner pair confluent with those on scutellum. Face bright mahogany. Venter pale.

Genitalia: Female last ventral segment one-half longer than preceding, lateral margins short, abruptly concavely rounded to produced posterior margin. Underlying membrane exposed at sides in form of lobes. Male valve broadly convexly rounding, plates triangular, much broader than valve at base, gradually narrowing to acute tips, thickly clothed with long hairs.

This is the first time that a male of *Euscelis texanus* has been described. Although Dr. Ball has recently placed this species in the Genus *Commellus*, the writer feels that it is apparently much more closely related to *Thamnotettix fitchii* than to any of the spe-

cies in the *Commellus* group. Externally these two species appear to be quite similar. Also, the internal genitalia indicate a close relationship. The styles are of the same general type, the chief difference being in the terminal processes, which are much more acutely produced in *fitchii*. The oedagi are quite similar. In a ventral view they are comparatively long and narrow, the apices shallowly concavely hollowed. In a lateral view the oedagus in *texanus* is more strongly curved and of a slightly different contour than in *fitchii*. In both species the oedagi are quite broad at the base, narrowing abruptly at about two-thirds their length to near the apices, which are broadened spatulate-like. The style-oedagus connectives are almost identical.

This species is known only from Louisiana and Texas.

Type locality Aaron, Texas. Type in Agricultural College collection, Ames, Iowa. Type examined, also specimens from Louisiana.

Deltocephalus dentatus Osborn and Ball

Athysanus dentatus Osborn and Ball, Proc. Dav. Acad. Sci., Vol. VII, p. 95, 1898.

Resembling *fuscinervosus* in form and appearance, but shorter, more robust, and with distinct genitalia. Length 3 mm.

Vertex obtusely rounding, less than twice as long as basal width. Elytra as long as abdomen and inclined to be flaring.

Color: Vertex pale straw, a distinct spot along anterior margin, a pair of oblique "V" shaped marks on disc, their inner arms united anteriorly. Pronotum pale straw with a distinct pair of round spots on anterior margin. Scutellum with a pair of spots on disc in line with those on pronotum. Elytra pale testaceous, subhyaline, nervures paler. Face pale testaceous with arcs of dark. Legs pale, venter dark. Ovipositor black.

Genitalia: Female last ventral segment as long as preceding, lateral margins short, abruptly concavely rounded to long, produced, blunt tips, between which posterior margin is slightly produced in two rounding lobes. Underlying membrane exposed at sides.

This species does not fall readily into any of the above groups. Although it appears to be closely related to *D. fuscinervosus*, it cannot be placed with any great degree of certainty until a male is at hand for examination.

Described from specimens taken in Colorado and since collected in Wyoming and Kansas (Osborn).

Type locality Colorado. Type in Agricultural College collection, Ames, Iowa. Type examined, also specimens from Wyoming and Kansas.

A COMPARATIVE STUDY OF THE INTERNAL GENITALIA AND THEIR BEARING UPON TAXONOMY

Several problems in taxonomy and relationship have presented themselves during the course of this study. The present discussion and figures are an attempt to throw more light upon the relationship by presenting the structures and data which will assist in solving some of the problems and establishing certain taxonomic relationships, as well as a critical study of the divisions made in present and previous studies.

All genera which have been previously established are confirmed in this study. One additional genus is established and one is removed from the *Deltocephalinae* and included in the *Euscelinae*.

In all of the groups except two, good specific characters are present. In these two groups, *Ophiola* and *Striellus*, it is apparent that in several of the species there is very little differentiation in genital characters, either external or internal.

Genus *Remadosus* Ball

Plates VI and IX

The two species included in this genus to date are very similar externally and can be readily separated only by a color character. An examination of the internal genitalia indicates a very close relationship. The styles are very similar and show no specific differences. The oedagi in a side view present the only constant specific characters which are found in the terminal portions. In *magnus* the apical portion is very acutely produced and a ventral spur is given off near the apex which curves posteriorly. In *fumidus* the terminal portion curves abruptly dorsally and posteriorly to the acute apex. The internal genitalia of *drakei* are identical with *fumidus* and as there appears to be specific external structural differences, *drakei* is here considered as a synonym of *fumidus*.

Genus *Drylix* Edwards

Plates VII and IX

This genus contains a number of species which are very similar

in external appearance and are readily separated only by the external genital characters. A study of the internal genitalia also indicates that the species are very closely related.

The styles are of the same general type. The chief difference seems to be in the length and shape of the terminal processes. In *striolus* the terminal portion is comparatively long and narrow while in the remaining species it is much shorter and broader, the apex is very blunt in *truncatus*.

An examination of the oedagi in a side view would show that the members of the group are very similar in general type. *Striolus* has an oedagus which is very broad at the apex and of a slightly different shape than is found in the other members of this genus, yet it undoubtedly shows a close relationship. *Parallelus* and *truncatus* are very similar, differing chiefly in the length and curvature of the apical portions. In *uneolus* the apex is not deeply bifurcate and curves anteriorly instead of posteriorly as in *parallelus* and *truncatus*. An anteriorly directed process of varying shape is articulated with the oedagus in each species.

In ventral view the oedagi show specific differences and in one case unique differences. *Striolus* has an oedagus which appears to be produced dorsally, the dorsal surface being much broader than the ventral surface. The apex appears scarcely bifurcate. The essential difference between *parallelus* and *truncatus* appears to be in the length and breadth of the bifurcate apices, which curve outwardly. In *uneolus* the apex is not deeply bifurcate and the tips curve inwardly.

In *divaricatus* the style is unique for the group. The terminal process is extremely long and acutely produced. It is slightly curved outwardly and a knot-like swelling appears on the inner margin. In a side view the terminal process is directed dorsally at a right angle. The oedagus in ventral view is short and broad, narrowed and concavely hollowed at the base. Also a pair of sharply produced processes project outwardly near the middle.

Genus *Exitianus* Ball

Plates VI and X

Obscurinervis, the only species placed in this genus to date, is probably of South or Central American origin and is structurally very distinct. The internal genital characters are also unique. From a ventral view the style is broad at the base, the lateral margins acutely produced. The terminal process is comparatively

long and curves abruptly laterally, almost at a right angle. The apex is acutely produced. The oedagus is very broad at the base, the lateral margins produced anteriorly. In a side view the basal portion of the oedagus is prolonged dorsally, while the body curves dorsad and cephalad, the apex appearing rather blunt.

Genus *Athysanus* Burmeister

Plates VI and X

Only two species remain in this genus, one of which was available for study. In *frigidus* the internal genitalia are of a rather simple type. The style is not greatly different from the type found in the other groups, broad at the base and tapering to the blunt apex. The terminal process is rather broad and slightly curved laterally. The oedagus in ventral view is relatively short and broad while in a side view it curves dorsally and anteriorly, the apex bifurcate, tips acute. An anteriorly directed process is articulated with the basal dorsal prolongation of the oedagus.

Genus *Euscelis* Brullé

Plates VII and IX

Externally the species of this genus appear very similar and indicate a close relationship. In several cases there has been some doubt as to the specificity of certain forms, but a study of the internal genitalia, although undoubtedly indicating a very close relationship, show sufficient differences in structure to separate them easily.

An examination of the oedagi shows two rather distinct types to which the species belong. In one of the groups we might place *alpinus*, *obsoletus*, *deceptus*, and *relativus*. The oedagi in all of these species are very similar. From a ventral view the oedagus is relatively broad at the base, but narrows abruptly, tapering gradually to the apex. In *alpinus* the oedagus is of a very generalized type while *obsoletus* shows a further development in being bifurcate at the apex. In *deceptus* and *relativus* the oedagi are very similar, the apical portion in each is expanded laterally. In a ventral view the oedagus of *relativus* is constantly much broader and the lateral margins are distinctly concavely hollowed for about half their length. From a side view the body of the oedagus in *deceptus* appears smooth and the apical portion seems to be produced hooklike. In *relativus* the dorsal surface of the oedagus

just posterior to the basal dorsal prolongation is produced in a spine-like process. The connectives are also different specifically. Although undoubtedly closely related, these two forms appear to show constant specific differences. In the second group we might place *extrusus* and *ovatus* which are very similar in structure. *Extrusus* is much larger than *ovatus* and the external genital characters seem to be specific. The style-like posterior productions of the pygofer also present good specific external characters for separation. The oedagi are very similar, broad at the base, the basal angles rounding in *extrusus*, acutely produced in *ovatus*. The oedagus bifurcates very near the base and curves dorsally in a slightly different manner in these two forms. At the base of the bifurcations a median process is given off which also curves dorsally, which in *ovatus* is much shorter and more acutely produced. The connectives are also different specifically. The styles probably show less variation than the other structures, although specific in most cases.

Genus *Ophiola* Edwards

Plates VIII and IX

The examination of the external structures of the species of this genus would indicate these species are very closely related. In fact in several cases there has been some question as to the specificity of certain forms. The external genital characters are almost identical throughout the group and entirely lacking in specific characters. An examination and study of the internal genitalia has led to the same conclusion, namely, that these species are very closely related.

The styles of the members of this group, with the exception of one or two species are of the same general type. The terminal portions are relatively long and bluntly terminated, varying slightly in width and curvature. *Luteola* has a style which is very slightly produced at the base and tapers gradually to the blunt terminal portion which does not appear definitely as a process. In *cuneata* the terminal process is short and roundly produced while in *angustata* the style is of slightly different shape and the terminal process is short and strongly curved.

An examination of the oedagi in side view shows that the members of this genus are very similar in general type. At the base the oedagus is directed dorsally and slightly anteriorly, similar in shape in all species examined except *luteola*. An anteriorly

directed process is articulated with this dorsal prolongation of the oedagus which is specific in several cases. The oedagi in *humida*, *arctostaphyli*, *comptoniana*, *shasta*, *cornicula*, *uhleri*, *anthracina*, *vara*, and *osborni* are very similar in size and shape. The oedagus is deeply cleft at its terminal portion, appearing bifurcate. In *humida*, *arctostaphyli*, *comptoniana*, and *osborni* the lateral margins are concavely produced to near the middle, then abruptly concavely rounded to acute divergent apices, while in *shasta* the lateral margins are convexly rounding to tips. In *humida* the body of the oedagus is constantly much shorter and narrower than in *arctostaphyli* while in *comptoniana* the terminal portion is much longer and more produced. The terminal portions of the oedagus of *uhleri* are broad to very near the apices, then abruptly narrowed to acute tips, while in *anthracina* the body of the oedagus is very broad, the terminal processes overlapping one another. *Cornicula* shows a further development in that a pair of short lateral processes are present on the terminal portions of the oedagus, which from a ventral view appears bifurcate. In *vara* the lateral margins are produced near the center in a spine-like process which curves forward. The process at the base of the cleft is much longer than in the other members of this group and the tips are not divergent. In *striatula*, *luteola*, *cuneata*, and *angustata* the body of the oedagus is shorter and more shallowly cleft, the terminal portion simple in *angustata*, *cuneata*, and *luteola*, while in *striatula* the apical portions are expanded laterally at the tips, the anterior margin at the base of the cleft also produced broadly spine like. *Luteola* is unique in that the basal portion of the oedagus is acutely produced in a second dorsally directed process.

Genus *Commellus* Osborn and Ball

Plates VI and IX

An examination of the external structures of the species of this genus would indicate that these species are very closely related. Within the genital chamber the sides of the pygofer appear to be produced in long spine-like processes which also are good specific characters.

The oedagus is rather short and relatively broad. From a ventral view the apical portion of the oedagus appears bifurcate and rests on a rectangular structure, which in *comma* is comparatively long and slightly constricted antero-posteriorly while in *colon* it is constantly shorter and more strongly constricted. From a side

view the anterior margin of this structure in *comma* is produced ventrally in a short, bluntly terminated spine like process. In *sexvittatus* the oedagus from a ventral view appears to rest on a pair of elongated structures which are not connected medianly. Attached to these median structures are broad bulb-like, posteriorly directed processes which show good specific differences in each case. From a side view the anterior portions of the oedagi in *comma* and *colon* are produced ventrally and postero-dorsally, apparently attached to ventral surface of the median structures. In *sexvittatus* the oedagus is produced ventrally and posteriorly between the styles. The posterior processes extend as far as the posterior margin of the anal ring to which they are generally attached by means of the surrounding membrane. The styles are of the same general type, showing no specific differences in *comma* and *colon*. In *sexvittatus* the basal and apical processes are much heavier and bluntly rounding.

Genus *Stirellus* Osborn and Ball

Plates VI and IX

Both of the species that have been placed in this genus are meadow feeders and occur most abundantly in southern localities. *Bicolor* is probably of subtropical origin. The internal genitalia are very unique, yet similar and exhibiting no specific differences. Although undoubtedly closely related, these two forms, *obtusus* and *bicolor*, are quite distinct externally.

Mexicanus, a species not yet found north of Mexico, has a similar type of genitalia, almost identical with the two forms mentioned above.

Genus *Amplicephalus* De Long

Plates V and X

Six species have been placed in this genus to date. Four of these, *osborni*, *simplex*, *estacadus*, and *lassus*, have been available in sufficient numbers for a study and examination of the internal genitalia. The styles are quite similar, although specifically different. In *simplex*, *lassus*, and *estacadus* the styles are broadest at the base, tapering to the apex, while in *osborni* the style is broadest at the middle. In *osborni*, *estacadus*, and *lassus* the oedagi are quite similar, especially from a ventral view, where the chief differences appear to be in the width of the tip and the length and depth of the concavity between the outer apices. From a lateral

view there is considerable difference in the shape and width of the tip and the position and direction of the basal dorsal spur. In *estacadus* the dorsal surface of the oedagus just posterior to the dorsal basal spur appears to be slightly concavely hollowed and produced in a short spine.

Genus *Amblysellus* nov.

Plates VI and X

In *curtisii*, the only species placed in this genus to date, the genitalia are quite distinct. The style-oedagus connective is long and broad. The styles are triangular in shape and the terminal processes are heavy and much produced. The oedagus in a ventral view appears long and narrow, tapering at the apex, which appears concavely hollowed. In a side view the oedagus is broad at the base, abruptly and strongly narrowing at about half the length, the apex curving upward.

BIOLOGY

At the present time very little is known regarding the biology of this genus. Osborn and Ball have made many valuable observations and records on the life history of certain members of this group during their work in Iowa. The data is readily accessible in several bulletins¹ and will not be repeated here.

ECOLOGY

The relation of plant associations to insects is steadily receiving more attention by present day workers. Within each of the climatic formations of North America there are a number of edaphic formations. Each of these edaphic formations is composed of plant associations which are related to each other as successional series correlated with gradual changes in the environment. With these changes in the environment insect successions occur which bear a definite relationship to plant associations. In a particular plant association certain species of insects tend to reproduce most abundantly. It has been pointed out that this is true for animals which feed directly on plants and those that do not. Therefore, it would be logical to assume that the combination of habitat factors which enables the particular plant association to develop and persist

¹ Osborn and Ball, Ia. Agr. Coll. Expt. Sta. Bull. XXXIV, p. 630, 1897; Osborn, U. S. D. A., Div. Ent., Bull. 108, 1892.

also present the most favorable set of environmental conditions for the reproduction of certain species of animals. When a particular host is used as a source of food by a certain species of insect, such a specialization is a limiting factor in the distribution of the species concerned. Students of particular species of insects, desiring an abundance of material, will save much time and labor by thinking in terms of plant association such as swamp, bog, meadow, *et cetera*, where experience has shown the species to reproduce abundantly.

Little detailed data is available in regards to the habits of the species of this group but the many observations of certain workers permit certain species to be grouped according to the type of habitat into prairie, swamp, bog, and meadow forms.

Prairie and Plains Formation

Comparatively few of the species of the genus occur on the prairies. Such forms as *comma* occur on *Buchloe*, *Elymus canadensis* and *E. striatus* and *colon* on *Stipa spartea*. *Magnus* is widely distributed through the prairie region on *Spartina michauxiana*. According to Osborn and Ball *obtusus* and *bicolor* occur normally on *Andropogon scoparius*, but at present have a much wider range of host plants and are not confined to the prairie regions.

Alpine Meadow Formation

Alpinus is the only species which is known to occur in the damp mountain meadows of Alpine regions.

Fresh Water Swamp Formation

Several of the species of this group are known to be definitely associated with the fresh water marsh formation. *Parallelus*, *cuneata*, *striolus*, and *divaricatus* occur on *Juncus*, *Elocharis* and small sedges along the margins of comparatively young lagoons. *Parallelus* also occurs abundantly in old lagoon basins while *striolus* occurs commonly on the *Carex-Phragmites* association which merges with wet meadows. *Cornicula* occurs on short grasses on marshy areas, while *extrusus* is at hand in marshy areas and low swampy places.

Bog Formation

Several species occur commonly in bogs. *Striatula* and *cornicula* occur in boggy associations including *vaccinium*. *Uhleri* and *humida* also are commonly found in boggy situations.

Moist Meadow Formations

Many species of this group are grass feeders and occur commonly in meadows and pastures. *Curtisii* is very abundant in blue grass meadows, *obscurinervis* is a widely distributed species and occurs on many grasses. *Obtutus*, *bicolor*, and *estacadus* are among other common meadow forms.

Anthracina and *uhleri* are quite commonly taken from high dry pastures.

Salt Marsh Formation

Three species are definitely known to occur in Salt Marsh Formation. *Simplex* is found as a rule upon *Spartina patens*, both nymphs and adults having been taken in abundance upon this plant. *Magnus* has been taken in abundance in both nymphal and adult stages from *Spartina patens*. *Funidus* occurs on a *Spartina-Rynchospora* association, but which plant is the true host is not definitely known.

ECONOMIC

Leafhoppers are undoubtedly of much more economic importance than the average entomologist is willing to concede. The potato, grape, and beet leafhoppers have demanded attention, but little has been given the grass feeding species. Provided with a minute beak designed for sucking, these small insects, scarcely observed, puncture the plant tissues, sucking the juices and draining the plant of its vitality. Unless passing the point where the constant drain causes wilting and withering, the injury is unnoticed, yet it results in lowered yield and less available pastures. Professor Osborn has estimated as many as one and a half million per acre of grass land.

Many of the species of this group are grass feeders and where occurring in sufficient numbers are to be considered of economic importance. Chief among the grass feeders are *obscurinervis*, *curtisii*, *obtutus*, *bicolor*, and *extrusus*. *Obscurinervis* and *curtisii* very commonly attack grains in sufficient abundance to cause considerable damage.

The best control measure known at present is the practice of clean farming. Burning the fields and fencerows during the winter is very effective. When fall grains are open to attack Professor Osborn advises burning the fields in late September. Rotation of pastures and meadows is a very good practice, as a two- or three-year-old pasture furnishes ideal breeding places. Osborn and Ball

also found that cutting the grass just after the eggs have been deposited resulted in the eggs being crushed by the wilting and drying of the plant.

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EXPLANATION OF PLATES

Plate I

Dorsal view of head and ventral view of female genitalia of species of Genera *Remadosus*, *Commellus*, and *Drylix*.

Plate II

Dorsal view of head and ventral view of female genitalia of species of Genera *Euscelis* and *Athysanus*.

Plate III

Dorsal view of head and ventral view of female genitalia of species of Genus *Ophiola*.

Plate IV

Dorsal view of head and ventral view of female genitalia of species of Genera *Ophiola*, *Exitianus*, *Stirellus*, and *Amblysellus*.

Plate V

Ventral and lateral view of internal male genitalia (top) *in situ*. Genus *Amplicephalus*, also *texanus* and *Thamnotettix fitchii*.

Dorsal view of head and ventral view of female genitalia (lower) of species of Genus *Amplicephalus*.

Plate VI

Ventral and lateral view of internal male genitalia *in situ*. Genera *Remadosus*, *Commellus*, *Stirellus*, *Amblysellus*, *Exitianus*, and *Athysanus*.

Plate VII

Ventral and lateral view of internal male genitalia *in situ*. Genera *Drylix* and *Euscelis*.

Plate VIII

Ventral and lateral view of internal male genitalia *in situ*. Genus *Ophiola*.

Plate IX

Comparative view of oedagi, ventral and lateral aspects, of Genera *Ophiola* (top), *Drylix*, *Commellus*, *Euscelis* (middle), and *Stirellus* (bottom).

Plate X

Comparative view of oedagi, ventral and lateral aspects (top), of Genera *Amplicephalus*, *Remadosus*, *Athysanus*, *Amblysellus*, and *Exitianus*. Also *texanus* and *Thamnotettix fitchii*. Comparative view of styles (lower) of all Genera.